UPPER OHIO NAVIGATION STUDY, PENNSYLVANIA
ENVIRONMENTAL APPENDIX

Fish and Wildlife Coordination Act 2(b) Report ORMSS

Fish and Wildlife Coordination Act Report on the
Ohio River Mainstem Systems Study
Programmatic Environmental Impact Statement
February 25, 2009

Note to Reader:

The U. S. Fish and Wildlife Service's Coordination Act Report prepared for the Corps of Engineers Ohio River Mainstem System Study in 2009 is reproduced here for reference. Their report provides agency recommendations concerning the Corps navigation activities on the entire Ohio River mainstem and impacts to natural resources of concern. Since the Service did not provide a separate 2(b) report for the Upper Ohio Navigation Study, the Service's recommendations on the mainstem river are considered to the extent that they apply to activities and resources in the Upper Ohio River study area.

United States Department of the Interior

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February 25, 2009

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Subject: FWS #06-0890; Transmittal of the Final FWCA for ORMSS Programmatic EIS

Dear Ms. Hawkins:

In response to your November 5, 2008 letter requesting a Final Fish and Wildlife Coordination Act (FWCA) report for inclusion in the Ohio River Mainstem System Study Investment Plan and Programmatic Environmental Impact Statement, the Service is pleased to provide the Corps with this Final FWCA report.

The following is a brief background leading up to the current status of this Final FWCA report. Our office prepared the draft FWCA report and sent it out for review in April of 2006 to the states of Illinois, Indiana, Ohio, Pennsylvania, West Virginia, and Kentucky; and, to the Service offices in these states. We then incorporated, as appropriate, the comments we received into the FWCA report and sent the Corps a "Draft" Final FWCA, dated July 18, 2006, which incorporated these comments. The Corps responded to this "Draft" Final FWCA report with a letter to the Service dated September 16, 2008. Our office then sent the "Draft" Final FWCA report along with the Corps' September 16, 2008 letter, to the states and Service offices, for a final opportunity to comment. We received only two comments, both from within the Service, complimenting the Corps on their commitments in the September 16, 2008 letter.

In the September 16, 2008 letter, the Corps expressed its desire and commitment to mitigate for systemic environmental impacts resulting from Corps actions within its legal and financial limits. The Service is pleased with the Corps' response to these issues, and we look forward to working with the Corps on specific projects as they come up in the future. We have included the Corps' September 16, 2008 response letter as an attachment to the Final FWCA report.

We have enjoyed working with the Corps during this process, and we look forward to continued joint efforts and opportunities to protect, preserve, and enhance the fish and wildlife resources along the Ohio River. We will send a copy of this letter and the Final FWCA to the states and appropriate Service offices. If you have any questions or comments pertaining to this Final FWCA report please contact Leroy Koch of my staff at 502-695-0468.

Sincerely,

Virgil Lee Andrews, Jr.
Field Supervisor

cc: Diane Lynch, USFWS, Region 5, Hadley, MA
Jeff Weller, USFWS, Region 4, Atlanta, GA
Jeff Gosse and Robert Krska, USFWS, Region 3, Minneapolis, MN

Attachment 1 – Final FWCA Report dated February 25, 2009
Attachment 2 – Corps' September 16, 2008 letter

ATTACHMENT 1

FINAL FISH AND WILDLIFE COORDINATION ACT REPORT

on the

OHIO RIVER MAINSTEM SYSTEMS STUDY
PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

by

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February 25, 2009

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I. EXECUTIVE SUMMARY

Background

Prior to the 18th century, the Ohio River flowed through essentially pristine lands. The River was free flowing throughout it entire length, with a diverse array of habitats including deep pools, rocky rapids, occasional waterfalls, sand and gravel bars, numerous snags and drift piles, sloughs, side and overflow channels, islands, and backwaters with submerged and emergent aquatic plants. A wide variety of habitat types prevailed and riverine aquatic life was abundant. In general, the river had pure water throughout most of the drainage basin. Extreme variations in flow are evident from early records. The first European settlers in the Ohio River Basin found a river bounded by vast, virgin hardwood forests, many marshes and other wetlands, and abundant supplies of fish and game.

This scenario has changed drastically over the last 150 years. Impacts from converting the forests to agriculture, industrial, mining, and development uses and the effects of population growth, invasive species, alteration the river by the Corps to allow for year round navigation, and other impacts, have and continue to play a role in the river's and watershed's appearance today. Today's appearance is much different than that of the early1800's, as are the challenges associated with managing the river.

Although the Ohio River has been modified greatly, it still remains a national treasure, with a rich history of culture, commerce and natural resources. However, some of these natural resources are declining, and the continued existence of some of these resources may be tenuous at best. Some resources are already gone, such as certain species of freshwater mussels that only occurred in riffles in larger river systems. Conservation of other imperiled resources, such as endangered and threatened species, migratory birds, mollusks, interjurisdictional fish, habitat on National Wildlife Refuge and other public trust lands, river shoals, backwaters, and islands, to name a few, will require active human intervention if they are to persist and improve. This will require a holistic view of resource conservation, recognizing that all resources are connected.

Role of the Fish and Wildlife Coordination Act Report (FWCAR)

This FWCAR is, essentially, an opportunity for the Service and States to provide recommendations to the Corps concerning the activities covered under the Ohio River Mainstem Study (ORMSS) Programmatic Environmental Impact Statement (PEIS) relative to potential or actual impacts to natural resources of concern. The Fish and Wildlife Coordination Act requires the Corps to include this report in their Final PEIS and requires that the Corps must give equal consideration to fish and wildlife resource recommendations from the Service and States regarding the Corps' activities considered under the PEIS. However, it is not mandatory for the Corps to accept the recommendations in the FWCAR.

Purpose and Goal of the Ohio River Mainstem Systems Study

The Corps' goal for the Ohio River Mainstem Systems Study (ORMSS) is to identify the best long-term comprehensive program for maintaining a viable navigation system on the main stem of the Ohio River while striving to achieve environmental sustainability. Specifically, the study's purpose is to evaluate the Major Maintenance, Major Rehabilitation, and New Construction investment needs for the 19 existing navigation lock and dam sites on the mainstem

with the aim to identify the optimum plan for meeting these needs over the next 40-50 years. This evaluation is intended to be adaptive and responsive to changes on the river and the river system.

A Systems Investment Plan (SIP) was developed by the Corps and is included in the ORMSS Programmatic Environmental Impact Statement (PEIS). The SIP takes into account the cumulative effects of Corps activities on the river into the future until 2060. The SIP is intended to be a guidance document for implementing new management practices, initiating non-structural efficiencies, and establishing budgets for future lock modernization feasibility and major rehabilitation studies.

The purpose of the PEIS, under the National Environmental Policy Act (NEPA), is to document consideration of various alternative Federal actions formulated to meet overall program goals and to disclose environmental impacts associated with those alternatives so that they can be disclosed and evaluated prior to making any decisions. The Corps' focus of this PEIS differs from EISs developed in the past for proposed construction at one or a few sites. This PEIS presents economic, engineering, and environmental information to evaluate broad system investment alternatives. The PEIS also provides information regarding overall impacts of the program, including cumulative effects, so that the decision-makers can make a reasoned judgment of the merits of the actions at the present state of planning or development by considering the effects of navigation improvements on environmental sustainability. This SIP/PEIS also provides information on sustainability status and needs of ecological resources throughout the study area.

The Cumulative Effects Assessment (CEA) that is included in this PEIS analyzes the impacts on the environment that result from implementation of the Ohio River mainstem navigation system modernization when added to other past, present, and reasonably foreseeable future actions regardless of the agency or person(s) undertaking such other actions. Consideration of cumulative effects requires a broader perspective than examining just the direct and indirect effects of a proposed action. It requires that future impacts be assessed in the context of past and present effects to each important resource requires consideration of a larger geographic area than just the immediate "project" area. One of the most important aspects of a cumulative effects assessment is that it requires consideration of how actions by others, including those actions completely unrelated to the proposed action, have and will affect the same resources.

In assessing cumulative effects, the key determinant of importance or significance is whether the incremental effect of the proposed action will alter the sustainability of the resource in light of other effects that the resource has or will experience. The CEA was prepared considering a reasonable upper limit of possible navigation improvement needs identified in the ORMSS in order to examine the total effects to each resource. For this reason, comparisons among alternatives are made in the SIP/PEIS rather than in the CEA report. Environmental issues are addressed in the CEA, and the Corps presents the use of environmental sustainability (ES) as an "ultimate test" for determining the significance of cumulative effects. ES is identified by the Corps as a "synergistic process whereby environmental and economic considerations are effectively balanced through the life cycle of project planning, design, construction, operation and maintenance to improve the quality of life for present and future generations.

The ES categories of the various environmental resources or Valued Ecological Components (VECs) included in the CEA are derived by combining the best professional judgment of the Corps Planning Team and Interagency Working Group (IWG) members with the cumulative effects of multiple actions as manifested through information available on indicators selected for each VEC. The Corps considers the ES categories to be somewhat qualitative. They are based on analyses of past and present conditions as well as future conditions related to trends, plans, laws, regulatory programs, and other sources of information that are beyond mere speculation. The general template the Corps used for ES categories is Not Sustainable (NS), Marginally Sustainable (MS), and Sustainable (S). The environmental sustainability of each VEC is presented over time as NS, MS, or S.

The Service believes the Corps has made a commendable effort to evaluate the various natural resources and assess their past, present, and future status. The Corps has taken an extremely complex, difficult, and contentious (at times) task and made great strides in working proactively with members of the IWG to provide the groundwork for future coordination on projects. The IWG is composed of the Service, State representatives, Corps, and other entities and persons. Given a diverse membership on the IWG, we expect that there will be some disagreements and interpretation of the FWCAR. However, we hope the Corps and other members of the IWG understand our insistence for a high level of continued communication and coordination as projects are identified and refined so that natural resources benefits can be maximized.

Impacts to Resources from Without Project Conditions and With Project Conditions

Since the Environmental Impact Statement is programmatic, specific future actions are not addressed in detail, and it is not the intention of this FWCAR to make a determination on specific project impacts to trust resources. We provide some general thoughts and commentary on impacts to trust resources in the FWCAR for the Without Project Conditions (WOPC) and With Project Conditions (WPC) scenarios, but the Service's primary intent is for the Corps to use our recommendations as guidance on their activities on the Ohio River.

As specific projects and opportunities occur in the future, we expect the Corps to involve the Service, States, and others in determining how each project will or may impact trust resources and to include the recommendations in this FWCAR, as appropriate, to help maximize the overall project benefits to natural resources. In addition, the Service expects the Corps to make every effort to avoid, minimize, and/or compensate for any impacts to trust resources.

The various scenarios of the WOPC and WPC presented by the Corps in the PEIS contain many uncertainties and leave us with few firm assessments as to what will actually happen in the future. We realize it is difficult to predict the future accurately, and we do expect navigation traffic to increase and the current infrastructure to become less reliable with age. The Service believes impacts on natural resources will likely continue much as they have in the past with some resources benefiting from the current condition of the river, and others, especially the more riverine components, continuing to decline or be reduced in extent or number.

Without Project Conditions

Regarding the Corps assessment of the WOPC, the Service believes that there will be continued adverse impacts to selected natural resources as a result of the locks and dams, navigation related

dredging activity, and other related navigation activities. This is expected to continue in a manner that is similar to past and current conditions. We believe there will be continued adverse impacts, especially to mussels, riverine fishes, riverine habitat and diversity, stream habitat quality, bottomland forests, and island habitat under the WOPC. We also expect these adverse impacts to vary depending on the resource, its location within the influences of the river, and over time.

With Project Conditions
The Corps addresses the WPC through their formulation of alternative system investment plans. Investment plans are defined by the Corps by the timing and specification of proactive maintenance and/or modernization projects at each lock and dam facility and are evaluated for each of the traffic forecasts the Corps presents in the PEIS in Section 8.2. The evaluations consider navigation and ecosystem benefits and associated environmental or ecosystem impacts.

The Corps has tentatively selected one System Investment Plan (SIP) as a basis from which a schedule of future site-specific feasibility studies will be developed. This SIP is essentially a process involving a mixture of structural improvements (new lock chambers), operational measures (helper boats and navigation upstream and downstream lockage policy during closures), and maintenance alternatives (reactive, advanced and rehabilitation). Significant Corps findings and recommendations from this process include: new lock chambers at Emsworth, Dashields and Montgomery to replace the existing auxiliary chambers; main chamber rehabilitations at all other mainstem projects except McAlpine and New Cumberland where auxiliary chamber rehabilitation is recommended and a reliable main chamber displaces the need for auxiliary lock extension under the current traffic forecast scenarios; and reactive maintenance or component replacement strategies which are intended to complement the recommended SIP.

The Service believes this mixture of structural improvements, operational measures, and maintenance alternatives presented in the SIP is a good approach. As a result, this approach will prevent the need for new lock extensions that could have potentially greater negative impacts to the natural resources. We recommend the Corps continue this evaluation process and refine it as needed as new information becomes available.

Regarding the Corps' WPC presented in the PEIS, the Service believes that there will be continued adverse impacts to selected natural resources as a result of the locks and dams, navigation related dredging activity, and other related navigation activities (e.g., loss of habitat due to shoreline development dependent on navigation). This is expected to continue to be similar to past and current conditions. We believe there will be continued adverse impacts to mussels, riverine fishes, riverine habitat and diversity, stream habitat quality, bottomland forests, and island habitat under the WPC. We also expect these adverse impacts to vary depending on the resource, its location within the extent of the river, and time.

<u>Involvement by Service, States, and other representatives</u>
Early in the ORMSS process, the Corps recognized a need to include Service, state agency representatives, and others in discussions of environmental concerns. The group was initially known as the Environmental Team, but it is currently called the Interagency Working Group. It was initiated in 1996 to (a) aid the Corps in the ORMSS process, (b) discuss topics of concern,

(c) provide technical expertise on natural resource topics, and (d) provide comments and review of Corps products being prepared for inclusion in the CEA/PEIS. Representatives from the Service's Ecological Field Offices in Illinois, Indiana, Ohio, West Virginia, Tennessee, and Kentucky participated in these group meetings. In addition, individuals at the Cartersville Fisheries Office in Illinois have been involved in this group, especially regarding fish related studies conducted by the Corps, and individuals from the Ohio River Islands National Wildlife Refuge in West Virginia, Pennsylvania and Kentucky are active participants on the IWG. Initially, the Service's Cookeville, Tennessee Ecological Field Office served as the Service's point of contact to the Corps. However, this point of contact is currently located in the Service's Kentucky Ecological Services Field Office located in Frankfort, Kentucky. State representatives, non-governmental organizations (NGO), and other participants, as appropriate, have been involved in this IWG. The Corps is commended for implementing the IWG as an environmental working group.

Other Recommendations and Considerations

Previous Ohio River-related FWCARs have usually been a result of specific Corps projects and detail efforts that the Corps implements to mitigate impacts to fish and wildlife resources near the project site. In this FWCAR, we hope to encourage the Corps to look at the entire river system and to consider and implement the recommendations contained in the FWCAR using a broad perspective. The Corps should use this FWCAR, as it develops specific projects in the future, as guidance on what the Service believes are important natural resource issues, concepts, and actions. As these projects are developed, we expect the Corps to find opportunities to cooperate and coordinate with the Service, States, and others regarding the guidance presented in the FWCAR and to develop additional levels of detail that can be analyzed.

The IWG should remained in-place and be encouraged to take an even more active role with the Corps. Additional participants should also be identified and asked to take part in the IWG (e.g., Coast Guard, academia, specialists, etc.). The Corps should work to foster the IWG's ability to meet to discuss issues relating to activities the Corps has on the river and the influences those activities have on various resources. The Corps also should provide consistent long-term funding to ensure that the collaborative efforts of the IWG are continued and that members are able to fully participate. This will add value to the process and improve the Corps' decision-making on future projects.

The Corps should continue to use adaptive management and monitoring to help determine and respond appropriately to natural resource priorities into the future (e.g., Ecological Restoration Program). We support the concept of adaptive management. However, we believe that the Corps should focus on adaptive management that achieves the greatest environmental benefits possible.

Connectivity of habitats and resources, through natural means and/or active human intervention, is critical to achieving sustainability for a rich variety and quantity of fish, wildlife, and other natural resources. Connectivity along the Ohio River is influenced by human activities in and along the river. The Corps locks and dams have been and will continue to be a long-term factor that limits connectivity, because they create long pools that separate semi-natural, riverine habitats. These structures, and the associated maintenance and other activities that collectively

ensure a navigable river, have often created or resulted in conditions where connectivity is diminished, inadequate, and/or absent. In some instances, connectivity can be enhanced and/or restored so the river can function better; however, in other instances it will likely require proactive intervention through the Corps' management, maintenance, and monitoring efforts for as long as the locks and dams, pools, and navigation-related activities exist.

As a Federal agency, the Corps has had the major role in creating and maintaining the current navigation system. The Corps' role in determining how the future navigation system will look includes the responsibility to minimize its impacts to natural resources and create conditions where natural resources can be enhanced, recovered, and sustained. This responsibility must also include ensuring that sufficient funding is available to achieve a high level of fish and wildlife resource sustainability. How best to achieve and maintain adequate funding for improving the river and its natural resources should be a top priority of the Corps.

The Service recognizes that as long as the locks and dams remain, the long stretches of pools exist, a navigation channel is maintained, and navigation plies the river, the riverine portion of the river will, at best, be only a remnant of its former extent. As a result, the ability of certain natural resources, especially freshwater mollusks and riverine fish species, to improve and/or achieve sustainability over a large extent of the river is problematic. Even though these challenges exist, there are significant opportunities that remain where the Corps could place its focus, especially those portions of the watershed that continue to contain riverine conditions or important riverine components. We believe a high priority should be placed on maintaining or improving the quality and quantity of resources in these remaining riverine segments. The Service recommends that the Corps conduct a river-wide, long-term assessment of these segments and develop a list of habitat restoration and enhancement projects for these resources along the full length of the river.

Elsewhere in this FWCAR, the Service provides several broad recommendations and specific recommendations to help guide the Corps towards achieving maximum overall project benefits, especially regarding the natural resources. These recommendations are a result of past, present, and anticipated future actions that could negatively impact the natural resources in and along the Ohio River. The following recommendations briefly describe selected priority actions, which are in no particular order and may be interrelated, that the Service recommends the Corps consider adopting, funding, and/or accomplishing:

1. Identify, describe, and quantify remaining riverine habitat in the Ohio River mainstem and larger tributaries. This baseline information will help in future adaptive management and monitoring activities to determine progress on achieving sustainability.

2. Collaborate with the Service, States, NGO's, and other entities to develop a vision for natural resource sustainability. This vision should be developed based upon realistic concepts of environmental sustainability and ecosystem restoration for the river and its resources. The Corps would then lead the implementation of this vision.

3. Maintain, restore and enhance high quality riverine habitat. The ability of the Corps to improve the quantity and quality of riverine habitat will be crucial in achieving environmental sustainability of the natural resources of the Ohio River.

4. Maintain, restore and enhance islands, backwaters and sidechannels, substrate, water quality, snags and/or other large woody structure, and flow conditions in the Ohio River and its tributaries to meet all life stage requirements for native riverine mollusks and riverine fishes, including interjurisdictional fishes and federally listed species.

5. Maintain, restore, and enhance the connectivity between riverine portions of the mainstem and tributaries, especially larger tributaries.

6. Maintain, restore, and enhance the riparian forest, bottomland forest, and wetlands and their functions and connectivity to the river, including embayments of the larger tributaries.

7. Maintain, restore, and enhance opportunities for fish passage at all locks and dams on the mainstem Ohio River in order to create improved connectivity between remaining riverine portions of the river. This will likely require construction of fish ladders and/or constructed streams circumventing the dams and the use of other adaptive management techniques.

8. Support and adequately fund propagation of selected freshwater mollusks and/or fish, especially rare species, for restoration and enhancement in the Ohio River mainstem and selected reaches of tributaries.

9. Support and adequately fund riverine fish and mollusk surveys and long-term trend monitoring of these resources throughout the Ohio River and the lower reaches of its larger tributaries.

10. Support the development and enhancement of shorebird, waterfowl, and water bird habitat, especially least terns.

11. Minimize physical impacts and pollution from barge traffic and barge fleeting, dredging and disposal, and other navigation related activities on the river that may negatively impact natural resources. Identify and make available appropriate upland disposal sites for dredge material and/or utilize dredge material for creating and/or enhancing natural resource habitat within the river.

12. Address how lock and dam facilities, and related navigation barge traffic, have played a role in the presence of invasive species, especially the zebra mussel, and determine and implement potential solutions (e.g., management of flows at appropriate times of year to retard settlement of zebra mussels, requiring decontamination of barges/tows entering the river, etc.) to prevent or minimize the impacts of zebra mussels and other invasive species to the native fauna.

13. Cooperative and collaborate with the Service and other federal, state, local agencies, NGO's, and others interested in working together to improve the river and its fish and wildlife resources.

The Corps has also undertaken another study, in cooperation with the Service and the states of Illinois, Indiana, Ohio, Kentucky, West Virginia and Pennsylvania, for the development and implementation of an Ohio River Ecosystem Restoration Project Partnership program, a large-scale ecosystem restoration initiative. The program would partner with non-Federal entities to restore, enhance, and protect fish and wildlife abundance, diversity, and habitats within the Ohio River watershed. This project is currently languishing primarily for lack of funding. We recommend the Corps make efforts to reinvigorate this project. A major impediment to implementation, if funded, is the current cost-share percentage of 65 percent federal and 35 percent non-federal. The Service offers the following suggestions that we believe would allow the program to proceed and meet its objectives:

1. Cost sharing will not be required for projects conducted on federal lands.

2. Project Planning and Design should be 100 percent federally funded.

3. Minimal cost-sharing (i.e., 10 percent) should be implemented for state and other conservation partners.

4. Block grants may be given to state agencies to administer for project design and construction.

5. The Corps should work with the Service and State fish and wildlife agencies to develop specific goals for the restoration program, and these goals should incorporate the goals of other ecosystem based fish and wildlife conservation plans (e.g., Ohio River Valley Ecosystem Team, Ohio River Fish Management Team, etc.).

6. A long-term monitoring program should be implemented to gauge the success of specific projects and the success of the program.

Construction of the past and current system of locks and dams and maintenance of a navigable river has allowed navigation and related activities to flourish, whereas the natural resources have often greatly suffered. The Service believes the Corps has responsibility under the FWCA to ensure that fish, wildlife, and natural resources conservation will receive equal consideration to maintaining a viable navigation system. The Corps should identify internal mechanisms and other ways that it could better provide sustainable natural resource conservation.

Section 7(a)(1) of the Endangered Species Act (ESA) requires that the Corps, as a Federal agency, shall, in consultation with and with the assistance of the Service, utilize its authority in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of the ESA. The Service believes that guidance under the FWCA and ESA provides the Corps with the necessary level of

discretion to develop and fund proactive programs and/or projects for the conservation of federally listed species and other natural resources in the Ohio River.

The recommendations and comments found in this FWCAR provide the Corps with guidance regarding conservation of natural resources. We believe the recommendations contained herein are realistic, obtainable, and fit in well with the goal of the Corps' ORMSS to identify the best long-term comprehensive program for maintaining a viable navigation system on the main stem of the Ohio River while striving to achieve environmental sustainability. For certain resources environmental sustainability will be difficult to achieve and/or determine. Success will require adequate funding along with the willingness to consider multiple ideas and ways of achieving sustainability. The Corps has a great opportunity to provide leadership in implementing these recommendations while working collaboratively with the Service, States, other entities, and individuals.

State Perspectives of the FWCA Report

This FWCAR was provided to the fish and wildlife agency in each state bordering the Ohio River for their review and comments. A copy of the letter received from each state is included as an attachment to this FWCAR. The following paragraphs provide a summary of the comments the Service received from each state, but for more detail please refer to the attachments.

In general, each state's review supported the Service recommendations presented in this FWCAR and recommend full implementation of those recommendations. There is a recognition that under current conditions and without implementation of the recommendations, the fish and wildlife resources of the Ohio River will continue to be impacted by on-going activities, and that some species may be driven to extinction.

One of the other topics commented on by the States is the time and effort expended by the IWG during the Corps' development of the ORMSS. In general, the States believe this collaboration and discussion was valuable, that it should continue at some appropriate level, and that the states should be active participants. In addition, the States expressed strong support for funding from the Corps to enable this to occur. The State of Ohio expressed concern that expanding the IWG may render it ineffective and suggested reducing the size of the IWG to a core working group that is tightly focused. The Service believes this suggestion has merit and that a small core group could be used to help a larger more inclusive group remain focused on particular issues.

Another topic raised by the States is the Ohio River Ecosystem Restoration Project. States agree that ecosystem restoration projects are critical to achieving sustainable use of the Ohio River, and that funding for this should be a top priority for the Corps. There is a realization that the Corps activities occurred by the direction of the U.S. Congress and that congressional funding is needed to evaluate and mitigate for impacts to aquatic and terrestrial wildlife resources. The current cost share arrangement discourages State involvement, and the States believe the cost share should be changed so that project funding requires less or no federal match, with ecosystem projects being fully funded without cost share requirements.

The states recognize the importance of achieving balance between the ecosystem and use of the river for commercial purposes. There is a need to develop a sustainable model for the Ohio

River. Emphasis should be on enhancing areas with some existing riverine conditions and restoring connectivity to tributary systems and adjacent forests and wetlands as part of that sustainability model. The Ohio River is highly used by navigation, industry, and utilities. The cumulative effects to the river's aquatic ecosystem from these uses are known. In light of the cumulative effects, the losses in fish passage, connectivity of the river, mussel depletion, fish population and habitat loss, wetland loss, and riparian fragmentation are pertinent to the discussion of sustainability. It was pointed out by the State of Illinois that the Cumulative Effects Assessment needs to entail more than just examining the direct and indirect effects of a proposed action and that a larger geographic area than just the immediate project are should be considered.

Habitat concerns are another subject the State's emphasized. Maintaining, restoring, and enhancing mainstem, backwater, and tributary habitats is critical to sustaining diverse and viable fish and wildlife populations in the Ohio River ecosystem. These issues require long-term, large-scale, and well-funded efforts to be meaningful. Habitat projects of the scale required to improve the Ohio River necessitate substantial and consistent funding, and the State's want to encourage the Corps to accept responsibility for such support. In addition, maintaining connectivity between riverine portions of the mainstem and larger tributaries is an important component of addressing habitat issues. On the specific subject of fish passage through locks and dams, the State of Ohio considered it to be a minor and expensive subject, but the State of Kentucky recommended that innovative approaches to fish passage be considered as new navigation projects are implemented.

II. PURPOSE, SCOPE, AND AUTHORITY

The purpose of this Fish and Wildlife Coordination Act Report (FWCAR) is to discuss the Corps' proposed Ohio River Mainstem Systems Study (ORMSS) Programmatic Environmental Impact Statement (PEIS), which evaluates alternative investment strategies for commercial navigation infrastructure on the Ohio River System for the next 60 years, for project related impacts to fish and wildlife resources and the measures can be taken to avoid or minimize adverse impacts. This FWCAR is an opportunity for the Service and States to provide recommendations to the Corps concerning Corps activities covered under this ORMSS PEIS and impacts to natural resources of concern. The Fish and Wildlife Coordination Act requires the Corps to include this report in their Final PEIS and give equal consideration to the recommendations from the Service and States. However, it is not mandatory for the Corps to accept the recommendations in the FWCAR. In those instances where the Corps disagrees or differs in the interpretation of our concerns and recommendations, the Corps should work with us to resolve the differences so that we can move forward together for the benefit of natural resources. This FWCAR constitutes the report of the Secretary of the Interior, as required by Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*).

The proposed Corps action is being conducted under the authority of United States Senate, Committee on Public Works resolution dated May 16, 1955; and United States House of Representatives, Committee on Public Works and Transportation resolution dated March 11,

1982. The Corps has been collecting data and pursuing approaches for the study of the Ohio River Navigation since 1996. Preliminary economic analysis has indicated traffic congestion and economic losses associated with foreseeable and anticipated maintenance cycles.

III. INTRODUCTION AND BACKGROUND

Provided below are selected prior studies regarding past investigations of natural resources in the Ohio River Basin.

1. Fish and Wildlife Resources of the Ohio River Basin (included as Appendix "G" in the Ohio River Basin Comprehensive Survey – (USFWS undated). The Service's report analyzed the fish and wildlife resource problems in the Ohio River Basin and furnished general solutions, especially as related to potential water development projects. The report also included the related needs of the present and future sportsmen of the area.

2. Planning Aid Report, Gallipolis Locks and Dam Replacement Study (USFWS 1980) discusses the high quality fish and wildlife resource areas within the primary study area. The study area included the Greenup and Gallipolis Navigation Pools on the Ohio, Kanawha, and Big Sandy Rivers.

3. Final Fish and Wildlife Coordination Act Report, Lower Ohio River Navigation Study, Kentucky-Illinois (USFWS 1985a) describes existing fish and wildlife resources of the Ohio River from the mouth of the Cumberland River (RM 920) to its confluence with the Mississippi River (RM 981). The report identifies potential impacts to these fish and wildlife resources from project alternatives, recommends project modifications to avoid and/or minimize these impacts, and outlines various mitigation needs associated with the project.

4. Planning Aid Report for the Fish and Wildlife Resources of the Upper Ohio River (USFWS 1986a) describes existing fish and wildlife resources of the Ohio River from Pittsburgh (mile 0.0) to the Pennsylvania-West Virginia-Ohio border (mile 40.0). The report focused on the results of fish sampling efforts undertaken in the summer of 1985 and on the ecologically significant areas, including wetlands, which could be affected by rehabilitation of the existing Emsworth, Dashields, and Montgomery Locks and Dams.

5. Final Environmental Assessment for the Ohio River Islands National Wildlife Refuge Proposal (USFWS 1989) outlined the various threats to important fish and wildlife resources within the study area. It analyzed various alternatives for long-term protection of important habitats, including land acquisition by the Service.

6. Reconnaissance Stage Planning Aid Report for the Uniontown Locks and Dams Study (USFWS 1991a) provided preliminary information concerning fish and wildlife resources that occur within the area of project influence and identified resource issues and concerns that could be addressed by the ongoing study.

7. Final Fish and Wildlife Coordination Act Report for the Olmsted Locks and Dam Project (USFWS 1993) was a supplement to the FWCAR report released to the Corps in 1985. The report evaluated changes in project design since the 1985 report and their potential for impacts to Federal trust fish and wildlife resources.

8. Draft Fish and Wildlife Coordination Act Report for J.T. Myers and Greenup Locks Improvements (USFWS 1999) provided information concerning fish and wildlife resources occurring within the project area as well as fish and wildlife resources within the Ohio River mainstem system. The report outlined ongoing impacts to these resources and predicted reduced or additional impacts as a result of project implementation. In that report, the Service also discussed the proposed restoration program and offered suggestions that the Service believed would allow the Program to proceed and meet its objectives.

9. Draft Fish and Wildlife Coordination Act Report on the Ohio River Ecosystem Restoration Project Partnership Program (USFWS 2000) discussed this large scale ecosystem restoration initiative.

10. Ohio River Islands National Wildlife Refuge Final Comprehensive Conservation Plan (CCP) published in November 2001.

The following are selected on-going studies and projects within the Ohio River Basin.

1. Ecosystem Restoration - The Corps has undertaken another study, in cooperation with the Service and the States of Illinois, Indiana, Ohio, Kentucky, West Virginia and Pennsylvania, for the development and implementation of an Ohio River Ecosystem Restoration Project. The program under consideration is a large-scale ecosystem restoration initiative. For details of this initiative see a report entitled *ORMSS Ohio River Ecosystem Restoration Program – Integrated Decision Document and Environmental Assessment, August 2000.* Although authorized by Congress it has not received funding and may soon become de-authorized for lack of congressional support. The Service encourages the Corps to find ways to implement this initiative in cooperation with the state agencies, other federal agencies, NGO's and others. In addition, the Service believes that the state fish and wildlife agencies or any other state agencies to be cost-share sponsors for these projects (U.S. Army Corps of Engineers 2000). Adequate funding for this Ecosystem Restoration Project should be a top priority for the Corps.

2. Ohio River Valley Ecosystem (ORVE) Strategic Plan - The Service's Ohio River Valley Ecosystem Team has developed and implemented a Strategic Plan for Conservation of Fish and Wildlife Service Trust Resources in the Ohio River Valley Ecosystem. The Team's several Sub-groups are the primary mechanisms for conducting activities on the ground and were formed on the basis of the resource priorities outlined in the Strategic Plan.

3. ORVE GAP Migratory Bird Resource Priority GAP Metaproject - This project will identify areas of importance within the Ohio River Valley Ecosystem to species of

migratory birds. Target bird species include songbirds that winter in South America or Latin America and breed or inhabit the ORVE during the spring and summer. Both Partners in Flight and Service personnel believe that these species are in particular danger due to stress caused by fragmentation and loss of habitat in both their wintering grounds and their spring and summer ranges. Loss of habitat and fragmentation have a number of effects upon a species and many of these are currently being studied. The purpose of the project is to identify areas in the Ohio River watershed that are of particular importance to these species of birds and present the information in an ArcView GIS format.

4. North American Bird Conservation Initiative (NABCI-US) - In the United States, the goals of this project are to bring together the bird initiatives already underway, including: North American Waterfowl Management Plan, Partners in Flight, U.S. Shorebird Conservation Plan, and the North American Colonial Waterbird Conservation Plan. Recognizing that the conservation interests of these initiatives can be better served through more integrated planning and delivery of bird conservation, the vision of NABCI-US is to "achieve regionally-based, biologically-driven, landscape-oriented partnerships that deliver the full spectrum of bird conservation across the North American continent and that support simultaneous, on-the-ground delivery of conservation for all birds" (North American Bird Conservation Initiative): Strategy and Action Plan, May 1999, http://www.bsc-eoc.org/nabci.html).

5. The U.S. Shorebird Conservation Plan - The development of this plan is a collaborative effort between researchers, land managers, and education specialists from the U.S. who will cooperate with colleagues from Canada and Mexico to advance effective conservation of North American shorebird species. The shorebird plan partnership has participated actively in the development of NABCI-US. The Plan, coordinated by Manomet Center for Conservation Sciences, focuses on three main components: 1) habitat management, 2) research and monitoring and 3) education and outreach. National working groups and smaller task groups and regional working groups were established to address issues in each of these areas. There are basically two planning areas, which include portions of the Ohio River mainstem area: Central Hardwoods and Appalachian Mountains. The Central Hardwoods area is included within the Upper Mississippi Valley/Great Lakes Regional Plan, but there will not be a regional shorebird conservation plan prepared for the Appalachian Mountains area.

Description of the Study Area

Prior to the 18th century, the Ohio River flowed through essentially pristine lands. The River was free flowing throughout it entire length, with a diverse array of habitats including deep pools, rocky rapids, sand and gravel bars, snag and drift piles, islands, and backwaters, along with an occasional waterfall. A wide variety of habitat types prevailed and aquatic life was abundant. In general, the river had pure water throughout most of the drainage basin; gravelly, rocky or sandy bottoms; and a lush growth of aquatic plants in the clear, shade-covered streams. Extreme variations in flow are evident from early records.

The Ohio River begins at the confluence of the Allegheny and Monongahela Rivers at Pittsburgh, Pennsylvania, and flows 981 miles to its confluence with the Mississippi River at Cairo, Illinois. Its present channel is roughly at the edge of the southernmost extension of the last glacial invasion of North America about 10,000 years ago (Pearson and Krumholz, 1984). When the first French and English explorers reached the river in the 1600's they described it as a beautiful, clean stream flowing through extensive hardwood forests, with marshy areas along the floodplain and at nearly every creek mouth (Pearson and Krumholz, 1984).

This scenario has changed drastically within the last 150 years or so. Impacts from converting the forests to agriculture, industrial development, mining, development and population growth, invasive species, and altering the river by the Corps to allow for year round navigation, and other impacts, have and continue to play a role in creating a river much different than the pristine scene prior to the early1800's.

After leaving Pennsylvania, the Ohio River forms a portion of the border of West Virginia, Ohio, Kentucky, Indiana and Illinois. The Ohio River has a relatively constricted channel upstream of Louisville, Kentucky (RM 606); however, small floodplains are common within portions of this river reach. The channel downstream of Louisville is not so constricted with the floodplains being relatively larger in size (Thorp 1992). The drainage area for the Ohio River Basin totals 203,940 square miles, including the Tennessee and Cumberland River drainages. The drainage area encompassed by Ohio River tributaries with drainage areas 1,000 square miles or more is 182,370 square miles, or 89.4 percent of the total drainage area. The Ohio River flows through four physiographic provinces, as described by Fenneman (1928): Appalachian Plateau; Interior Low Plateau; Central Lowlands Plateau; and, Coastal Plain.

The location of the Ohio River made it important as a route to the west and a transportation route to the sea. The first settlers in the Ohio River Basin found a river bounded by vast, virgin hardwood forests, many marshes and other wetlands, and abundant supplies of fish and game. Agricultural lands attracted the first settlers and today the western portion of the basin is part of one of the most important agricultural regions in the U.S. The early settlers cleared the forests and drained many of the wetlands between 1800 and 1900 (Pearson and Pearson, 1989). One of the major effects of this clearing and draining was increased siltation into the river due to soil erosion from the fields and pastures.

A joint committee of the Ohio Valley states met in 1819 for the purpose of improving the Ohio River for navigation. The commission mapped 102 obstructions between Pittsburgh, Pennsylvania, and Louisville, Kentucky. In 1824, Congress passed the General Survey Act, which gave the U.S. Corps of Engineers continuing authority for navigational studies. In 1827, Congress passed the first Rivers and Harbors Act to authorize Federal removal of river obstructions and improve harbors. Removing snags and dredging sand bars were popular means of navigation improvement. The first Federal dam on the Ohio River was built in 1838 at Brown's Island to divert the river around one side of the island. The first navigation lock was built five miles downstream of Pittsburgh at Davis Island in 1885 to create a harbor at Pittsburgh that could hold 12,000 boats and barges. At one time, there were 54 wicket dams in operation on the Ohio River. With the completion of Olmsted Locks and Dam, currently under construction, all of the previous wicket dams will have been replaced by a series of 19 lock and dam projects,

predominantly with high lift dams. Presently, the Ohio River mainstem is maintained by the Corps as a series of relatively flat pools providing for year-round navigation.

With increased industrialization of the Ohio River valley, water quality of the river began to degrade because of the combination of waste loadings from the manufacturing processes and the increased population pressure that followed the industrial boom (Cavanaugh and Mitsch, 1989). However, the lower 150-200 miles of the river was not polluted as badly, since fewer people lived along that portion of the river and several large tributaries provided additional dilution. The water quality of the Ohio River continued to deteriorate and was at its worst during the droughts that occurred in 1930-31 and 1934 (Pearson and Krumholz, 1984).

In 1948, the governors for the states along the Ohio River established an interstate Ohio River Valley Water Sanitation Commission (ORSANCO) to fight the growing water pollution problem in the river. As a result of this effort, a valley-wide educational program was started, new state laws were passed, industrial committees set control standards for industrial wastes, and many new pollution control installations were made (ORSANCO, 1998).

During the period 1973 to 1985, Van Hassel et al. (1988) found decreased numbers of pollution tolerant fish species, and increased numbers of more pollution intolerant species, indicating improvement in the water quality and fishery of the Ohio River. Ohio River sediment samples taken in 1987 generally had lower concentrations of cadmium, chromium, copper, iron, lead, nickel and zinc, and higher values for manganese than did sediment samples taken in 1977 (Youger and Mitsch, 1989). Although there were and are some reductions in the concentrations of metals, concentrations generally remain well above background and may be a source of water contamination in the Ohio River for the future (Youger and Mitsch, 1989).

Trends in Ohio River water quality indicate increasing concentrations of chloride, pH, suspended sediments and arsenic, and decreasing concentrations of sulfate, dissolved oxygen deficit and lead. Atmospheric deposition is suggested as a causal factor for the changes in nitrate, lead, arsenic and cadmium concentrations. Municipal waste treatment, use of highway salts and nitrogen fertilizer and regional trends in coal combustion are suggested as other significant influences on the water quality of the river (Cavanaugh and Mitsch, 1989). More recent data collected by OSANCO between 1980 to 1990 for total phosphorus, nitrate/nitrite nitrogen, and ammonia nitrogen indicates either no change or decreasing concentrations in nutrient parameters at most of the 16 Ohio River sampling locations. However, nutrients have been identified as a concern on Ohio River tributaries (Heath et. al., unpublished).

The Ohio River basin constitutes approximately 20 percent of the Mississippi Watershed, and contributes about 35 percent of the Mississippi River's total flow at its entrance to the Gulf of Mexico. Preliminary data indicate that a significant amount of nutrients delivered to the Gulf come from the upper Mississippi River and Ohio River watersheds contributing to a zone of hypoxia in the Gulf of Mexico.

IV. ALTERNATIVES

A "conditional" without-project condition (WOPC) and with-project conditions (WPC) are described and evaluated by the Corps in the ORMSS PEIS. The Corps WOPC scenario is essentially keeping the system in operation without 'new' investment. The Corps WPC scenario describes a 'process' of which selected to determine what course of action will be taken. These are briefly described below, but the ORMSS PEIS should be referred to for greater detail.

Without-Project Condition Alternatives

The following information regarding WOPC is largely derived from Section 8 of the SIP/PEIS and Section 8 of the SIP- Economics Appendix. Please refer to these sections for greater detail on the WOPC alternatives.

WOPC - Formulation

The WOPC has traditionally been defined as the most likely condition expected to prevail on the Ohio River mainstem throughout the planning horizon in absence of additional project (Congressional) authorizations. For the ORMSS, this definition has been expanded by the Corps to reflect their current philosophy concerning planning for a highly uncertain future. One of the most critical determinants of the need for future investments in the Ohio River Navigation System, and at the same time the most uncertain, is the demand for waterway commodity movements through all Ohio River locks.

The Corps formulation of the WOPC begins with the existing locks and their current performance and structural condition. It involves maintenance of the existing system in the absence of new investment in the system. It assumes implementation of expected and economically-justified, nonstructural measures within the Corps authority, operational measures (e.g., helper boats, revised lockage policies), and includes authorized improvements either under construction or are pending appropriation.

The Corps defines a range of alternative scenarios that describe the potential demand for transportation of major commodities transported on the river. The scenarios are not evaluated with respect to numerical probability or likelihood of occurrence, and a single most probable without-project condition is not identified.

Multiple Scenarios of Projected Traffic Demands

To address the inherent difficulties associated with predicting traffic forecasts on the Ohio River, the Corps presents five navigation traffic forecasts. Two of the five forecasts were based on information obtained from utility surveys regarding their plans in light of environmental regulations. These scenarios are termed the 1) **Utility-Based** and 2) **Utility Based-High** scenarios. The difference between these two is that the Utility Based-High scenario assumes high economic growth. The remaining three scenarios were based on the output of models. The first of these is a continued application of existing laws, specifically the National Ambient Air Quality Standards. This scenario is referred to as the 3) **NAAQS** scenario. The second reflects implementation of the administration's multi-emissions proposal, the Clear Skies Initiative, as an amendment to the Clean Air Act. This proposal, referred to as the 4) **Clear Skies** scenario could be expected to have a fairly profound impact on the use of coal by electric utilities, largely

because of the proposal's implied mercury emissions restrictions. The final scenario would be implementation of the Clear Skies initiative without the severe mercury restrictions that are included under Clear Skies. This scenario is referred to as the 5) **No Mercury Limitations** Scenario. All of the forecast scenarios reflect the effects of coal switching by ORS-dependent utilities to meet the requirements of existing or proposed environmental regulations. The two utility-based forecasts reflect the outlook of the utilities themselves.

Specifically, the goal of this approach is to define a range of reasonable alternative scenarios that ultimately describe the potential demand for transportation of major commodities transported on the Ohio River. A consequence of applying a scenario-based approach to traffic forecasting is multiple representations of the WOPC. However, scenarios are not evaluated with respect to numerical probability or likelihood of occurrence. A single most probable WOPC, therefore, is not identified.

The Corps has stated the consideration of the impacts of various scenarios greatly enhances the decision-making process, and that this scenario-based approach is consistent with the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G), the procedural and analytical framework for Corps feasibility studies. The WOPC is determined for each traffic scenario the Corps presents.

After determination of the applicable future scenarios for traffic demands, the formulation of the any WOPC scenario begins with a comprehensive evaluation of the existing locks and dams, pools, channels, and existing operation and maintenance rules during normal operations and when main chambers are closed, their current performance, and their structural condition. The Corps indicates that the definition or choice of the WOPC is not obvious and that it is not necessarily the status quo or existing condition. It may involve certain improvements in the Corps' current ways of doing business that do not require Congressional authorizations. It is assumed that any reasonable and economically justified nonstructural practice within the Corps of Engineers' discretion (i.e. not requiring Congressional Authorization) will be implemented at the appropriate future time. For example, operational alternatives, the use of helper boats, revised scheduling and lockage policies, and various maintenance alternatives have been examined for their ability to improve project performance to ensure the best use of the existing facilities. The WOPC will also include authorized improvements that are either under construction or are pending appropriation (e.g., Olmsted, Greenup, and J.T. Myers Locks and Dams). The most likely WOPC will not include any proactive maintenance requiring an investment decision.

However, the importance of the WOPC is not changed; it still serves as the basis against which impacts of project improvements/additions requiring Congressional authorization (in any WPC) are measured. The net system-wide transportation savings (benefits less costs) and impacts to the valued environmental components (VECs) due to any WPC can be compared to those values in the corresponding WOPC (i.e. based on the same set of economic and environmental forecasts). Likewise, the environmental and social measures of any WPC can be compared to those of the appropriate WOPC.

WOPC – Existing Condition

As navigation projects age, component reliability worsens and maintenance requirements and unscheduled closures typically increase. Development of a WOPC begins with an assessment of existing conditions, capacity, and demands. The performance of each lock is affected by each lock's availability for service. For example, the age and level of use for each lock varies within the system. The Corps identifies strategies for maintaining and operating the Ohio River locks for each navigation traffic forecast scenario in the WOPC. The Corps identifies three different maintenance plans it develops and analyzes in the SIP. They include reactive maintenance, advanced maintenance or component replacement, and rehabilitation maintenance (bundled components). Since both the advanced component replacement and major rehabilitation require an investment decision, they were not considered alternatives for the WOPC. They are, however, considered in the WPC. In the absence of new investment, a reactive maintenance plan is assumed by the Corps to be the base maintenance plan for the WOPC. Under reactive maintenance, components are fixed or replaced only after they perform unsatisfactorily.

The WOPC also includes the following currently authorized projects:

1. Myers auxiliary chamber extension – In the Corps analysis, the auxiliary chamber at Myers is scheduled for extension in years 2009 and 2010. Myers is modeled as twin 1200' x 110' locks beginning in 2011. This project is not yet under construction.

2. Greenup auxiliary chamber extension and main chamber rehabilitation – In this Corps analysis, the Greenup auxiliary chamber is extended in 2008 and 2009 and the main chamber in 2010 and 2011. The project is not yet under construction.

3. Olmsted Locks and Dam – Olmsted locks and dam (twin 1200' x 110' chambers) were authorized to replace Locks and Dams 52 and 53. Construction began in 1993, but completion is not expected until 2011.

4. McAlpine lock replacement – A new 1200' x 110 chamber was authorized to replace the existing 600' x 110' auxiliary chamber. Construction began in 1996 and is scheduled for completion in 2008.

Projected Traffic Demands

Traffic demand forecasts for this study represent an update of previous forecasts completed in the spring of 1999 for the J.T. Myers and Greenup Locks Improvements Feasibility Report. New forecasts were prepared for all commodity groups, but because of the dominance of utility steam coal on the system and the uncertainties surrounding the regulatory future, alternative scenarios were developed only for utility coal and sorbent materials (lime and limestone) used for coal desulfurization. The dominance of these commodities shipped on the Ohio River is expected to continue through the planning period although other commodities continue to represent a significant percentage of traffic in the future as well.

The current round of adjustments to the utility coal forecasts was necessitated by existing and likely future regulatory changes affecting the electric utility industry. Coal that moves by barge to electric utilities accounts for nearly half of all traffic on the Ohio River System (ORS). This

market for coal continues to receive much attention from government regulators, the Congress, and the public. Regulation and law governing coal's use overseas, and stiff competition from competing exporting countries, has been responsible for the near disappearance of the steam coal export market, particularly in Europe. For the ORS, the result has been the first prolonged period of coal traffic stagnation. While other commodities and barge-served markets face uncertainty, none matches the dominance of coal or level of uncertainty regarding future use. Environmental issues are acknowledged by industry experts to be the dominant issues expected to affect future coal utilization and sourcing on the part of the electric utilities. In light of this, five alternative forecast scenarios were developed, three of which directly reflect alternative legislative approaches to emissions reductions. A "broad-based" or single projection for all other traffic is also made and incorporated into each of these scenarios.

Traffic demands for the Ohio River mainstem show similar patterns to those for the ORS. Ohio River mainstem traffic annually accounts for about 87 percent of total system traffic throughout the forecast period. In 2020, traffic demands range between 273.6 million tons under the Clear Skies scenario and 306.1 million tons under the Utility-Based High scenario. In 2060, the range is between 322.3 and 443.2 million tons. Annual growth between 2000 and 2060 under Clear Skies is 0.5 percent and under the Utility-Based High scenario 1.03 percent. Over the 1970-2000 period, growth rates for traffic on the Ohio River mainstem were substantially higher than for the ORS overall (2.1 versus 1.7 percent per annum). For the forecast period, growth rates for the ORS are slightly higher under all scenarios, indicating that traffic demand growth for tributary streams, especially the Tennessee River, are higher than the mainstem.

Lock-Level Traffic Demands

Since most of the forecasts were arrived at independently and since considerable coal switching takes place in some of the forecasts, the forecasts can align quite differently at the locks. For example, the high forecast at one lock might not be the high forecast at another.

Environmental regulations can affect coal sourcing for various plants, and this in turn can affect coal movements through the Ohio River facilities. Under most of the forecast scenarios, projected growth rates are the highest for the lower river locks. This arises since utilities are expected to include more coal from western sources, including the Illinois Basin, as well as more coal from the Northern Appalachian area. The increasing demand for coal from these sources, which is relatively high in sulfur content but lower in cost than coals now used from the Kanawha basin, is thought to be due to the fact that scrubbers are becoming more widespread, which render the sulfur content of coals less important. The impact of increased use of coal from western sources would be to increase coal movements through the lowermost Ohio River locks but lower the same through the middle and upper locks. Northern Appalachian coal always has and is expected in the future to move primarily on the middle and lower Ohio River (serving, for example, the Florida coal market). The increased use of Northern Appalachian coal would result in traffic growth downstream of and including Hannibal. The utility-based scenarios show the lowest growth rates occurring at the uppermost locks on the Ohio, while the NAAQS, Clear Skies, and No Mercury Limits scenarios show the lowest growth rate occurring at projects on the middle river. Generally speaking, the NAAQA, Clear Skies, and the No Mercury Limits scenarios are more pessimistic concerning the future of Central Appalachian coal than the utility-based scenarios.

However, over the projected longer term, the high and low alternatives that emerge are the Utility-Based High scenario and the Clear Skies scenario. In year 2020, the forecasts range between 318 million tons under the Clear Skies scenario and 350.4 million tons under the Utility-Based High scenario. By year 2060, the range is between 368.7 and 511.0 million tons for these same scenarios. Annual growth for the 2000-2060 period ranges from 0.51 percent to 1.06 percent. This is compared to average annual growth over the 1970-2000 period of 1.7 percent per year.

WOPC Conclusions of the Service

Regarding the Corps assessment of the WOPC, the Service believes that there will be continued adverse impacts to selected natural resources as a result of the locks and dams, navigation related dredging activity, and other related navigation operations and existing activities. This is expected to continue to be similar to past and current conditions. We believe there will be continued adverse impacts to mussels, riverine fishes, riverine habitat and diversity, stream habitat quality, bottomland forests, and island habitat under the WOPC. We also expect these adverse impacts to vary depending on the resource, its location within the river, and time.

With Project Conditions (WPC)

The Corps addresses the WPC through their formulation of alternative system investment plans. Investment plans are defined by the Corps by the timing and specification of proactive maintenance and/or modernization projects at each lock and dam facility and are evaluated for each of the traffic forecasts the Corps presents in the PEIS in Section 8.2. The evaluations consider navigation and ecosystem benefits and associated environmental or ecosystem impacts.

In Section 10 of the ORMSS PEIS the Corps has tentatively selected one SIP as a basis from which a schedule of future site-specific feasibility Studies will be developed. The approach the Corps took to determine the SIP is best summarized in Section 10 of the SIP/PEIS.

This SIP is essentially a process involving a mixture of structural improvements (new lock chambers), operational measures (helper boats and navigation upstream and downstream lockage policy during closures), and maintenance alternatives (reactive, advanced and rehabilitation). Significant Corps findings and recommendations from this process include: new lock chambers at Emsworth, Dashields and Montgomery to replace the existing auxiliary chambers; main chamber rehabilitations at all other mainstem projects except McAlpine and New Cumberland where auxiliary chamber rehabilitation is recommended; a reliable main chamber displaces the need for auxiliary lock extension under the current traffic forecast scenarios; and reactive maintenance or component replacement strategies which are intended to complement the recommended SIP.

The Service believes this mixture of structural improvements, operational measures, and maintenance alternatives as presented in the SIP/PEIS is a good approach. As a result, this approach will prevent the need for new lock extensions that could have potentially greater negative impacts to natural resources. We recommend the Corps continue this evaluation process and refine it as needed as new information becomes available (i.e., adaptive management).

Regarding the Corps WPC presented in the PEIS, the Service believes that there will be continued adverse impacts to selected natural resources as a result of the locks and dams, navigation related dredging activity, and other related navigation activities. This is expected to continue to be similar to past and current conditions. We believe there will be continued adverse impacts to mussels, riverine fishes, riverine habitat and diversity, stream habitat quality, bottomland forests, and island habitat under the WPC. We also expect these adverse impacts to vary depending on the resource, its location within the river, and time.

V. DESCRIPTION OF AFFECTED RESOURCES

The Ohio River

Previous alterations to the Ohio River as a result of dam construction and operations, maintenance of the river for navigation traffic, and floodwalls and levees have resulted in permanent alterations to the structure and function of the river and the surrounding habitat. Cumulative impacts from human activities including direct habitat loss through development and floodplain encroachment, pollution, bank erosion and siltation of embayments, increased use of the river for water supply, recreation, navigation, etc. These impacts continue to accrue and degrade the quality and quantity of remaining habitat. Conversely, water quality improvements, mainly due to the passage of the Clean Water Act, have allowed many species to begin to recover from previous impacts and to recolonize areas that were previously unsuitable. Although habitat encroachment will continue, benefits derived from improved water quality, if not coupled with other improvements, will likely plateau.

Ohio River Fisheries

The Ohio River and geologic predecessors, as parts of the Mississippi Drainage, have provided habitat for large river fishes for 200 million years. The evolution and distribution of freshwater fishes in this large river system have been shaped by many geologic events—continental drift, sea level fluctuations, climatic changes, the advance and retreat of glaciers, and the establishment of land bridges between North America and both Asia and South American. The fish community of the Mississippi Drainage is exceptionally rich in species, harbors many ancient or relic forms, contains several evolutionary lines not found elsewhere in the world, and represents the center of adaptive radiation for freshwater fishes in North America (Pearson and Pearson, 1989). A distinctive assemblage of fish species that occur mainly in the Mississippi and Ohio Rivers and the lower reaches of their major tributaries inhabit the big rivers. Shovelnose sturgeon, paddlefish, skipjack herring, river shiner, goldeye, silverband shiner, and blue sucker are characteristic examples of the big river fishes found in the Ohio River.

The human activity that probably resulted in the most disruptive influence on Ohio River fish communities is the series of locks and dams constructed on the Ohio River mainstem. The dams have inundated and facilitated siltation of extensive reaches of formerly clean gravel or rubble substrate. This coarse substrate provided the predominant lithophilic fishes (fishes which spawn over clean gravel-rock) with their preferred spawning substrate, which is now in reduced supply.

The Louisville District Corps developed and utilized a mathematical model to assess the impacts that project-induced increases in navigation traffic would have on selective aquatic resources. A

review of the document "Incremental Environmental Effects of Commercial Navigation Traffic, Olmsted Locks and Dam Study, Navigation Predictive Analysis Technique (NAVPAT)" (undated) revealed that the existing project conditions have substantially reduced the habitat quality of the river for fifty percent of the life stages evaluated and five of the seven species evaluated. The quality of the river's spawning habitat for sauger, paddlefish, and spotted bass has been significantly degraded by the development of the river as a navigation corridor (USFWS, 1993).

Most Ohio River fishes spawned in the mainstem, predominantly in the shore-debris zone of the river. Many of the lithophilic fish (i.e., shovelnose sturgeon, redhorses, blue sucker, and paddlefish) have declined in abundance, while fishes, which produce pelagic eggs, and/or larvae that float above the bottom (i.e., freshwater drum, emerald shiner and gizzard shad) have increased in relative abundance. Fishes that spawn over vegetative matter (i.e., buffalo-fishes and carpsuckers) appear to have remained stable. Nest guarding sunfishes and basses primarily occur where protected embayments and backwaters are available for spawning. After 1900, a number of fish species apparently declined in abundance, including: lampreys, shovelnose sturgeon, paddlefish, muskellunge, and blue sucker. One would also expect that the smaller, riffle-inhabiting species also were more abundant prior to 1900. Fish that were reported from the Ohio River mainstem prior to 1920, but have not been located since that time include: least brook lamprey; Alabama shad; horny head chub; Ozark minnow; and crystal, mud, gilt and longhead darters (USFWS 200). By 1950, populations of a number of fish species were further reduced in abundance, including: lake sturgeon; shovelnose sturgeon; bigeye chub; blue sucker; and muskellunge (Pearson and Krumholz, 1984). And, since 1970, lake sturgeon, as well as burbot (which may have been introduced), southern redbelly dace, dusky darter, and banded sculpin have not been reported from the mainstem Ohio River. Species which probably also declined during the period 1900-1980 include: shortnose gar; mooneye; white sucker; redhorses; buffalofishes; and smallmouth and spotted basses (Pearson and Krumholz, 1984).

Species for which there appears to be no change in abundance include: emerald shiner, channel catfish and freshwater drum. Between 1900 and 1980, species, which increased in abundance, include: common carp, gizzard shad, threadfin shad, and perhaps, river carpsucker (Preston and White, 1978). Based on lock chamber rotenone sampling, the ten most abundant fishes in the Ohio River are: emerald shiner; gizzard shad; freshwater drum; mimic shiner; channel catfish; common carp; bullheads; skipjack herring; white crappie; and threadfin shad.

Several species of fish have been introduced to the Ohio River mainstem, at least six fish have established populations in the river and include the carp, goldfish, white catfish, silver carp, bighead carp and banded killifish (Pearson, 1992). Among other introduced species, it is likely that rainbow smelt and northern pike will establish populations (Pearson and Pearson, 1989). In addition, there are 13 fish species that have only been reported from the river since 1970, three of which may have small populations only recently discovered: flathead chub, channel darter, and slenderhead darter.

According to Johnson (1987), 18 percent (28 species) of 159 fishes reported from the Ohio River are considered rare enough to be protected by law in one or more of the states bordering the Ohio River. An additional 13 percent (21 species) are considered to be of "special concern" by one or

more of these same states because of "...low numbers, limited distributions, or recent declines." The Ohio River populations which might be particularly threatened include silver lamprey, least brook lamprey, lake sturgeon, paddlefish, alligator gar, Alabama shad, flathead chub, blue sucker, crystal darter, channel darter, and slenderhead darter (Pearson and Pearson, 1989).

It is likely that the dams interfere with fish movements, which in the past eliminated the spring run of Alabama shad, and perhaps are now impairing movements of a number of other fish species (Pearson and Pearson, 1989; Burr and Page, 1986). However, some large river species (e.g., paddlefish, spotted gar, mooneye, and highfin carpsucker) have been able to recolonize upstream areas in the last 20 years as water quality improved dramatically in the upper half of the river. Populations of pollution-tolerant species (e.g., bullheads and carp) have declined in the upper third of the river over the past years, while populations of many relatively pollution-intolerant species (e.g., Hiodontids, *Moxostoma* spp., and walleye) have increased.

Lock chamber studies during the period 1957 through 1980 indicates that, after 1960, there were significant increases in densities of all fishes combined in the upper 100 miles of the river, and between ORM 400-600 and ORM800-900. Species diversity indices increased significantly in the upper 100 miles of the river between 1957 and 1980. Nearly all species of fishes increased in density between 1957 and 1980, with the most dramatic increases after 1974 (Pearson and Krumholz, 1984). It appears that fish communities are responding positively to the continuing improvements in water quality in the Ohio River.

The emerald shiner and mimic shiner are most abundant in the upper third of the river, while the freshwater drum is most abundant in the lower two-thirds of the river. Gizzard shad and channel catfish are evenly distributed throughout the mainstem. Generally, larval fishes are present in the Ohio River between April and September, with densities the greatest in May and June. Larval fish density increases from the upper to the lower river. Cyprinid and percid larvae are the most abundant larva in the upper third of the Ohio River, while clupeids, cyprinids, and catostomids are most abundant in the lower two-thirds of the river.

Ohio River Mussels

Approximately 300 species of freshwater mussels (Family Unionidae) occur within the United States of America. Freshwater mussels reside in permanent bodies of water ranging from large lakes to small streams. The vast majority of the species prefer streams with the most diverse assemblages occurring in riverine shoals or gravel bars. Within the United States, the most diverse freshwater mussel fauna known occurred in the mainstems of the Tennessee River (102) species), Cumberland River (87 species), and Ohio River (72 species) (Parmalee and Bogan, 1998; Johnson, 1980). All three of the rivers occur within the Ohio River watershed, which historically supported approximately 127 distinct species and subspecies of freshwater mussels. Of this once rich mussel fauna, 11 mussels are extinct, 34 mussels are classified as Federally endangered, and others are under review for possible addition to the federal Endangered Species List. The Ohio River basin contained over 42 percent of the continent's mussel fauna, and of the 127 species in the basin, the mainstem Ohio River was home to over 56 percent of the basin's mussels. Only 48 of those 72 species have been found alive or fresh dead in the mainstem in the past 20 years (Watters 2004; ESI 2000). In less than 100 years, nearly half (44 percent) of the

Ohio River basin's mussel fauna has become extinct, endangered, or been decimated to the point where Federal protection is being considered.

The Ohio River watershed's mollusk (snails and mussels) fauna has been adversely affected by impoundment, siltation, channelization, in-stream dredging and disposal for navigation, commercial sand and gravel dredging and pollution. Reservoirs have flooded and destroyed many mussel populations, which is one of the primary causes of their demise in large rivers. Because the current velocity decreases as the flow approaches a dam, there is a greater amount of silt deposited in the lower pool areas. With the changes in current flow and velocity, silt has dropped out on some mussel assemblages in quantities great enough to reduce or extirpate the mussels (Williams and Schuster, 1989).

Within the watershed, coal mining related siltation and acid mine drainage have adversely impacted many stream reaches with freshwater mussels. Numerous streams within the watershed have experienced mussel kills from toxic chemical spills; poor land use practices have fouled many waters with silt; and runoff from larger urban areas has degraded water and substrate quality.

Continued mussel losses can be expected because many of these same factors still threaten existing populations. Also, many of the mussel populations are now isolated and reduced to such small remnant reproductive units that they may contain insufficient genetic diversity to provide for long-term survival. In addition, some species exist only as old individuals that may no longer be capable of reproduction.

The diversity of Ohio River freshwater mollusks is critically threatened by the recent invasion of the exotic zebra mussel into the Ohio River basin. Zebra mussels rapidly expanded their range in the Ohio River. Zebra mussels were first observed in the lower Ohio River in 1991 and had expanded upriver to Cincinnati by 1992. By 1993, low densities of zebra mussels occurred in the upper reaches of the Ohio River and only a few unionids near Cincinnati had zebra mussels on their shells. By 1999 they were present all the way up to Pittsburgh (Patty Morrison, personal communication). Concurrently, unionids and snails in the lower Ohio River were covered by large numbers of adult zebra mussels. Observations in 1994 found zebra mussel densities still relatively low in the upper Ohio River, but very high in the lower Ohio River. Dunn (1995) reported that, in 1994, every unionid observed below Portsmouth, Ohio had zebra mussels. Commercial and recreational boating activities increases the probability of unintentionally translocating exotic species such as the zebra mussel from one river reach or drainage basin to another in bilge water, on hulls, engine components, mooring lines, fishing tackle, trailers, wet suits, and other navigational components and leisure equipment.

Encrustation by zebra mussels has a severe energetic cost for native unionids (Berg et.al., 1993). There is a strong relationship between the degree of zebra mussel infestation and mortality of native unionids in rivers and lakes (Schloesser, 1995). Zebra mussels impair locomotion and burrowing of native unionids. They impact native unionids by preventing valve closure, preventing valves from opening, and causing food deprivation.

Zebra mussel infestations in the Ohio River and its major tributaries have reached such densities that the future health of many of the freshwater mussel populations are imperiled. Effective strategies to control zebra mussel populations along the Ohio River will probably depend on complementary efforts designed to identify and reduce existing upriver source populations, and to prevent vessels from transmitting zebra mussels upstream to replenish these populations (Steingraeber, 1999 [draft]).

Ohio River Migratory Birds

On the Ohio River, areas around islands, flooded sloughs and other backwater and/or embayment areas provide important habitats for water birds. Wetlands and shallow water zones associated with islands/backchannels provide habitat on which waterbird (i.e., waterfowl, shorebirds and wading bird) populations depend, particularly during migration. Mature forested wetlands and bottomland hardwoods provide important nesting habitat for species such as wood ducks, osprey, and great blue herons, and the inland and fringe wetlands are important brood rearing areas. Embayments are also important, particularly those areas containing submerged and emergent aquatic vegetation.

Neotropical Songbirds

The Ohio River Valley Ecosystem (ORVE) Migratory Bird Resource Priority Metaproject was created in an effort to identify areas of importance to species of migratory birds. Target bird species include songbirds that winter in South America or Latin America and breed or inhabit the Ohio River Watershed during the spring and summer. These species are in particular danger due to stress caused by fragmentation and loss of habitat in both their wintering grounds and their spring and summer ranges.

Targeted bird species of concern within the ORVE include: Bewick's wren; cerulean warbler; golden-winged warbler; wood thrush; Louisiana waterthrush; worm-eating warbler; blackburnian warbler; Henslow's sparrow; eastern wood peewee; loggerhead shrike; hooded warbler; black and white warbler; dickcissel; yellow-billed cuckoo; yellow-throated vireo; field sparrow; whip-poor-will; Aadian flycatcher; black-billed cuckoo; black-throated blue warbler; chestnut-sided warbler; ovenbird; northern parula; Canada warbler; prairie warbler; gray catbird; Bachman's sparrow; summer tanager; great-crested flycatcher; short-eared owl; eastern phoebe; scarlet tanager; cedar waxwing; and northern (Baltimore) oriole.

Waterfowl

More than fourteen species of waterfowl utilize the islands and the various other riverine habitats. The majority of the waterfowl are migratory, using the habitats as feeding and resting areas. Annual floods, primarily during the winter to spring period, create areas attractive to migratory waterfowl. Bottomland hardwoods produce mast, e.g., acorns, which are used extensively as a food source by mallards, black ducks and wood ducks when flooded. The more open sloughs produce emergent vegetation used by widgeon, gadwall, blue-winged and green-winged teal, and ring-necked ducks. These fertile wetlands also produce an abundant invertebrate resource that is vital as a source of protein to spring migrating ducks.

There are two principal fall migration routes for waterfowl in the basin. The eastern route cuts across northern Ohio and Pennsylvania to the Atlantic Coast. The western route enters the basin

in northeastern Indiana and northwestern Ohio; follows the historic Kankakee marsh area in northern Indiana; and then proceeds down the Wabash River to wintering grounds in southern Indiana, Illinois, northwestern Kentucky, and farther south. There are minor flyways down other rivers such as the Scioto, White, and mainstem of the Ohio River.

The lower Ohio River is encompassed by the Mississippi Flyway and, as such, is an important migratory route with significant wintering populations of ducks. The lower Ohio River area is also part of the wintering area for the Mississippi Valley Population (MVP) Canada geese. An estimated 800,000 MVP geese winter in southern Illinois, southwestern Indiana, eastern Missouri, and western Kentucky. The Southern James Bay Canada Goose population migrates through Ohio, Pennsylvania, Indiana, and Kentucky to wintering grounds in Tennessee and Alabama.

North American Waterfowl Management Plan - The North American Waterfowl Management Plan (USFWS 1986b) provides a framework for waterfowl conservation and management efforts by describing population and habitat goals. The Plan's major premise is that the maintenance of abundant waterfowl populations is dependent on the protection, restoration and management of habitat. The Plan sets goals for waterfowl populations based on species numbers during the decade of the 1970's.

In concert with the Plan, 10 habitat joint ventures were established in the United States and three in Canada. Parts of the Ohio River are included within joint venture areas: the Lower Mississippi River Valley Joint Venture, the Upper Mississippi River Joint Venture, and the Atlantic Coast Joint Venture. Within the UMRJV, the New Madrid focus area includes portions of the Ohio River mainstem area in Illinois and Indiana. The Kentucky portion of the Ohio River is included in the LMRVJV, and the West Virginia and Pennsylvania portion of the Ohio River are in the ACJV. Habitat joint venture actions include protection, restoration, and enhancement of wetland and associated upland habitats. Protection strategies include habitat acquisition, conservation easements, leases, and management agreements with private landowners. Habitat enhancement activities include rest/rotational-grazing practices, seasonal flooding of active croplands, and construction of nesting islands and structures for waterfowl and songbirds.

Presently, each state's waterfowl and waterfowl habitat objectives are undergoing review to develop site-specific focus area objectives. A draft of these site-specific objectives should be available in the near future.

Dabbling ducks are the most abundant and widespread group of ducks breeding in North America. This group includes: black duck, mallard, widgeon, pintail, gadwall, green-winged teal, blue-winged teal, cinnamon teal, shoveler and wood duck. Continuing habitat degradation and loss since the early 1960's have diminished the likelihood of these populations recovering to former abundance without innovative and intensive management on private and public lands, greater efforts to preserve existing habitat, and changes in land use and agricultural practices on private lands.

Bottomland forests, freshwater marshes and areas with submerged aquatic vegetation provide important habitat for wintering waterfowl. In addition, bottomland forests provide important

breeding habitat for wood ducks. Although no specific habitat goals have been established for protection/restoration of wetlands in the Ohio River floodplain, the amount of remaining wetlands within the Ohio River mainstem area has been severely reduced. A draft Ohio River Basin Commission report (1978) indicated that the wetlands remaining along the Ohio River total 19,500 acres or 2.3 percent of the 846,700-acre floodplain (1978). Of that amount, only approximately 3,400 acres of wetlands were protected at that time by encroachment from development (0.4 percent of the floodplain).

Shorebirds

A number of shorebird species (for example: lesser and greater yellowlegs; spotted sandpipers; semipalmated plovers) utilize the Ohio River corridor during both spring and fall migration. Important areas include mud flats and emergent wetlands.

U.S. Shorebird Conservation Plan – The U.S. Shorebird Conservation Plan is a collaborative effort between researchers, land managers and education specialists from the U.S. who will cooperate with colleagues from Canada and Mexico to advance effective conservation of North American shorebird species. The Plan, coordinated by Manomet Center for Conservation Sciences, will focus on three main components: 1) Habitat Management, 2) Research and Monitoring, and 3) Education and Outreach. National working groups as well as smaller task groups and regional working groups have been established to address issues in each of these areas.

The Ohio River mainstem falls within two of the shorebird planning regions: Upper Mississippi/Great Lakes and Appalachian Mountains. The shorebird planning units are organized to correspond with the newly created Bird Conservation Regions. The first joint meeting between regional working groups of the shorebird plan, Partners in Flight, the Atlantic Coast Joint Venture, and the Colonial Waterbird Plan focused on cooperative approaches to bird conservation. The result of this effort will identify migration timing in each of eight regions, important migration staging areas, and management and conservation opportunities and concerns on a regional basis.

Colonial Waterbirds

Colonial waterbird species whose ranges encompass all or a part of the mainstem Ohio River area (Peterson, 1980) include:

Herring gull (B,M,W)	Ring-bill gull (W,M)
Bonaparte's gull (M)	Caspian tern (M)
Least tern (B,M)	Great blue heron (B,W, M)
Louisiana heron (I)	Great egret (B, M)
Snowy egret (I,M)	Cattle egret (I)
Green heron (B,M)	Black-crowned night heron (B,M,W)
White/faced ibis (I)	Glossy ibis (I)
Yellowed-crowned night heron (B)	Common tern (M)
Forster's tern (M)	Double-crested cormorant (IB, M,W)

B=breed; W=winter; M=migrant; I=incidental

North American Colonial Waterbird Conservation Plan - There is an initiative to develop a North American Colonial Waterbird Conservation Plan to advance the conservation of colonial-nesting waterbirds (seabirds, terns, wading birds, gulls) and their habitats in North America. It is a partnership of non-governmental agencies, researchers, private individuals, academics, and federal and state governmental agencies that will develop the Plan over the next two years. The goal is to develop a plan whose implementation will result in sustainable populations, distributions, and habitats of colonial-nesting waterbirds throughout North America, including breeding, migratory, and wintering ranges. The Plan is being developed in concert with other bird conservation planning efforts underway; these efforts include the North American Waterfowl Management Plan, Partners in Flight Bird Conservation Strategy, Important Bird Areas, and Shorebird Conservation Plan.

Endangered Species

The federally listed endangered (E), threatened (T), and candidate (C) species whose ranges include the project study area are shown in the following table:

Common Name	Scientific Name	Listing Status
Mammals		
gray bat	*Myotis grisescens*	endangered
Indiana bat	*Myotis sodalis*	endangered
Birds		
bald eagle	*Haliaeetus leucocephalus*	threatened
Interior least tern	*Sterna antillarum*	endangered
Mussels		
clubshell	*Pleurobema clava*	endangered
cracking pearlymussel	*Hemistena lata*	endangered
dromedary pearlymussel	*Dromus dromas*	endangered
fanshell	*Cyprogenia stegaria*	endangered
fat pocketbook	*Potamilus capax*	endangered
Northern riffleshell	*Epioblasma torulosa biloba (=rangiana)*	endangered
orangefoot pimpleback	*Plethobasus cooperianus*	endangered
pink mucket	*Lampsilis abrupta*	endangered
Purple catspaw	*Epioblasma obliquata obliquata*	endangered
Rayed bean	*Villosa fabilis*	candidate
Ring pink	*Obovaria retusa*	endangered
Rough pigtoe	*Pleurobema plenum*	endangered
Sheepnose	*Plethobasus cyphyus*	candidate
Spectaclecase	*Cumberlandia monodonta*	candidate
Tubercules blossom	*Epioblasma torulosa torulosa*	endangered
White wartyback	*Plethobasus cicatricosus*	endangered
Winged mapleleaf	*Quadrula fragosa*	endangered
Plants		
Running buffalo clover	*Trifolium stoloniferum*	endangered
Short's goldenrod	*Solidago shortii*	endangered

Gray bat

The gray bat occurs primarily in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. Smaller populations, however, are known to occur in northwestern Florida, western Georgia, southeastern Kansas, southern Indiana, southern and southwestern Illinois, northeastern Oklahoma, northeastern Mississippi, western Virginia, and western North Carolina (Barbour and Davis, 1969; Tuttle, 1979). Historically, distribution was patchy, but fragmentation and isolation of populations is increasing (USFWS, 1982).

Each summer colony occupies a traditional home range that often contains several roosting caves scattered along as much as 70 km of river or reservoir border (USFWS, 1982). The gray bat may range up to 20 km from occupied caves while out feeding at night, and nearly always feeds over streams and rivers with good wooded canopies along the bank (USFWS, 1982). Foraging is generally parallel to streams, over the water at heights of 2 to 3 meters. Activities which modify the cave environment in any way, or which create large breaks in the feeding or travel corridors used by gray bats may have negative impacts. Mayflies are a major food source.

The gray bat is habitat restricted. It occurs only in limestone caves, and only a few caves provide the appropriate temperature and humidity conditions required by the species. Maternity colonies are usually in rather large caves containing substantial streams. Evidence suggests that colonies travel from summer to winter caves and often stop at transient caves. The times of maximum migration are in April and September.

The gray bat's known summer distribution in Indiana is limited to Clark, Crawford, Floyd and Harrison Counties. The only known summer roosts are in Clark County in the watersheds of Silver Creek and a couple of small Ohio River tributaries. In Kentucky, gray bats are most common and widespread in the caves of the "Pennyrile" region of western and west-central Kentucky. Of the Kentucky counties that border the Ohio River mainstem, there are isolated records for Breckinridge, Meade, Hardin, Bullitt, Crittenden and Livingston Counties. Summer colonies are also likely to occur in these counties. Of the Illinois counties that border the Ohio River mainstem, isolated records are available for Hardin, Pope and Pulaski Counties.

Impoundment of waterways, water pollution and siltation causes loss of foraging habitat and flooding of caves. Pesticides also present a major threat.

Indiana bat

The scientific name for the Indiana bat is *Myotis sodalis.* Formally listed as endangered throughout its range, on March 11, 1967, *Myotis sodalis* is currently protected under the Endangered Species Act of 1973 (Public Law 93-205). Critical Habitat was designated for the Indiana bat on September 24, 1976 (41 FR 41914); 11 caves and 3 mines in six states are listed as Critical Habitat.

The Indiana bat has a body approximately the size of a small mouse (body length of 7.5-9 centimeters). The wingspan is several times the average body length, ranging from 24-27 centimeters. Weights range from 4.5 – 9.5 grams, with females being larger than males. The historical range of the Indiana bat encompasses the eastern United States extending westward to Oklahoma, Iowa, and Wisconsin.

Indiana bats hibernate during the winter months. By entering a state known as torpor, they greatly reduce their metabolic rate and survive off the body fat they accumulate in the fall. Indiana bats hibernate in limestone caves and abandoned underground mines, known as hibernacula. They require very specific habitat features in these hibernacula, with cool, stable temperatures preferably between 4°C and 8°C, and humidity above 74% but below saturation.

After hibernation, most females depart from the caves and abandoned underground mines during April, while males typically remain longer before migrating to summer habitat. A few males may even occupy the hibernacula during the summer months. Females migrate to summer habitat where they will congregate to bear and raise young, in what are known as maternity colonies. Pregnant females typically give birth to single young in late June. These juveniles are capable of flying within a month. Indiana bats travel, forage, and roost within a variety of interconnected forested habitats, including riparian corridors, bottomlands, and uplands. Indiana bats typically roost under exfoliating bark, in cavities of dead and live trees, and in snags (i.e., dead trees or dead portions of live trees). Trees in excess of 16 inches diameter at breast height (DBH) are considered optimal for maternity colony roosts, but trees in excess of 9 inches DBH appear to provide suitable maternity roosting habitat. Male Indiana bats have been observed roosting in trees as small as 3 inches DBH.

Water sources for the bat include stream corridors, ponds, and water filled road ruts in forests. Diet of the Indiana bat can vary within a night, seasonally, between years, and across its range. Despite this variability, diet generally includes flies, moths, beetles, and caddisflies as the most important prey, suggesting some selectivity by the bats. Although Indiana bats can feed opportunistically, as demonstrated with alate ants, it is unlikely that the Indiana bat is a strict generalist or opportunist, and this species may best be described as a "selective opportunist". Current literature suggests that the Indiana bat has a flexible diet that probably is influenced by available foraging habitat and available prey, and possibly by local, interspecific competition (e.g., gray bats and eastern pipistrelles).

Upon arrival at hibernacula in August-September, Indiana bats "swarm," a behavior in which "large numbers of bats fly in and out of entrances from dusk to dawn, while relatively few roost in the hibernacula during the day". Swarming continues for several weeks and mating occurs during the latter part of the period. Fat supplies are replenished as the bats forage prior to hibernation. Indiana bats tend to hibernate in the same hibernacula in which they swarm, although swarming has occurred in caves other than those in which the bats hibernated. During swarming, males remain active over a longer period of time at entrances than do females, probably to mate with the females as they arrive. Studies conducted in Kentucky have shown that males tend to forage within 1.5 miles of the hibernacula during this time. However, in West Virginia, male Indiana bats roosted within 3.5 miles in trees near ridgetops, and often switched roost trees from day to day. After mating, females enter directly into hibernation. A majority of bats of both sexes hibernate by the end of November. Hibernation is driven mainly by ambient temperature and may occur later or earlier depending on weather conditions.

Bald eagle

The bald eagle was federally listed as endangered in 1978 (43 FR 6233, February 14, 1978), and was downlisted to threatened status in 1995 (60 FR 36000, July 12, 1995). The downlisting was

a direct result of the banning of DDT and other persistent organochloride pesticides, as well as habitat protection and other recovery efforts. The bald eagle was formally proposed for delisting on July 6, 1999 (64 FR 123; pages 36453-36464).

In general, eagles nest in close proximity to lakes, rivers, or reservoirs. They construct their nests near habitat ecotones, such as lakeshores, rivers, and timber management areas (clearcuts or selective cuts). Tolerance of human activity during the nesting season has been variable, but, ideally, human disturbance of eagles should be avoided. The bald eagle's food base from the watershed includes carrion, waterfowl, and especially fish.

In Indiana, there are recent wintering records from all Ohio River counties except Dearborn, Floyd, Ohio and Switzerland. The area surrounding the Wabash River mouth in Posey County is considered a primary wintering area (John Castrale, IDNR, personal communication). Portions of the Ohio River in Livingston, Crittendon, Union and Henderson Counties, Kentucky are known to be used by wintering bald eagles (L. Burford, Kentucky Department of Fish and Wildlife Resources, pers. comm.). In addition the bald eagle is common in the winter along the West Virginia, Ohio, and Pennsylvania portion of the river, as long as the river remains relatively free of ice, and a recent (unsuccessful) nesting attempt was made by a young pair of eagles in 2001 near Parkersburg, West Virginia (Patty Morrison, personal communication). The Sloughs Wildlife Management Area, Henderson County, Kentucky, is a highly productive nesting area. In Indiana recent nesting activity has occurred in Harrison, Crawford and Posey Counties. The possibility remains that nests may become established along the Ohio River during the life of this project, particularly in the vicinity of established nesting territories.

Interior Least Tern

The interior least tern population was estimated at 1,250 individuals in 1980. This low number coupled with the obvious continued loss and degradation of nesting islands led to the listing of the species as endangered in 1985. There is little historical information on population numbers. However, it is widely accepted that the interior least tern population was affected by loss of nesting habitat, for which there is documentation. Nesting habitat loss occurred primarily from the various channelization and irrigation projects and the construction of reservoirs and pools along many interior river systems within the population's range.

Throughout the population's range (which includes the lower Ohio River) the primary factors which limit abundance and distribution of the least tern include: 1) limited availability of suitable nesting habitat; 2) predation; and 3) human disturbance to nesting colonies. Riverine nesting areas are sparsely vegetated sand and gravel bars within a wide, unobstructed river channel. The size of the nesting areas depend on water levels and the extent of associated sandbars. Other characteristics of valuable nesting habitat include: close proximity to shallow water areas with concentrations of forage fish; isolation of the sand/gravel bar such that access by mammalian predators is limited; and elevation of the sand bar such that inundation is precluded in most years during the nesting season while allowing for periodic flooding that scours encroaching vegetation.

Within the population's range, the construction of navigation pools and channel training structures have altered river processes that once created and disturbed riverine habitats, including

sand/gravel bars, throughout the river system. In the lower Ohio River, the Corps is working with the Service and the appropriate state agencies to determine if dredged material can be used to create nesting habitat in Ohio River waters. These efforts have shown some success in creating nesting habitat (Bob VanHoff, Louisville Corps, 2004, personal communication). Recent surveys of terns in the lower Mississippi River have indicated an increase in the population size (John Rumancik, Memphis Corps, 2004, personal communication).

Endangered Freshwater Mussels

Historically, there were 72 species of freshwater mussels reported from the mainstem of the Ohio River (Johnson, 1980). Several federally listed endangered mussels are thought to be either extirpated or very near extirpation in the Ohio River mainstem, including the white-wartyback, *Plethobasus cicatricosus*; cracking pearlymussel, *Hemistema lata*; rough pigtoe, *Pleurobema plenum*; winged mapleleaf, *Quadrula fragosa*; northern riffleshell, *Epioblasma torulosa rangiana*; and purple catspaw, *E. obliquata obliquata*. Also, the tuberculed blossom , *Epioblasma torulosa torulosa*, once occurred in the Ohio River but is now considered extinct. Historical records indicate that the dromedary, *Dromus dromas*, may have occurred in the mainstem Ohio River, but is not currently thought to be present. The endangered ring pink, *Obovaria retusa*, may be present but has not been reported from the mainstem Ohio River recently. In addition, the Service has determined that three other mussels can be justified for listing under the ESA: rayed bean, sheepnose, and spectaclecase. The remaining species of federally listed mussels are known and/or believed to be extant and various locations in the Ohio River and are discussed below.

Clubshell

Historically, this species had an extensive range and was abundant in many states including Alabama, Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, Tennessee, and West Virginia (USFWS, 1994). It historically existed in the Ohio River basin in the Ohio, Allegheny, Scioto, Kanawha, Little Kanawha, Licking, Kentucky, Wabash, White, Vermillion, Mississinewa, Tippecanoe, Tennessee, Green, and Salt River drainages. It also has been recorded from the Maumee River basin and tributaries of western Lake Erie (Huron River and River Raison).

In the Ohio River basin the best current populations exist in the Allegheny River system in Pennsylvania and the Tippecanoe River system in Indiana. The most recent report for the clubshell from the mainstem Ohio River is a report of a (presumably live) clubshell from the Haunted Hollow mussel assemblage in Harrison County, Indiana during Clark's 1993-1994 Ohio River survey (1995).

This species occurs in small to large rivers in clean swept sand and gravel substrate. The clubshell's decline can be attributed to many factors; however, the primary factors include impoundments, channelization, loss of riparian habitat, and the impacts of silt from poor land uses. Water pollution from municipalities, chemical discharges, coal mines, and reservoir releases also have impacted the species. The recent invasion of the zebra mussel poses an additional threat to this species.

Fanshell
The fanshell inhabits gravel substrate in medium to large rivers of the Ohio River basin. The species' distribution and reproductive capacity has been impacted by the construction and operation of reservoirs and by other impacts on water and substrate quality. Unless new populations are found or created, and existing populations are maintained, this species will likely become extinct in the foreseeable future (USFWS 1991b). Historically, this species was widely distributed in the Ohio, Wabash, Cumberland, and Tennessee Rivers and their larger tributaries in Pennsylvania, Ohio, West Virginia, Illinois, Indiana, Kentucky, Tennessee, Alabama, and Virginia. The best reproducing populations remaining are found in the Green River and Licking River in Kentucky and the Clinch River in Virginia and Tennessee. A small population exists in the upper Kanawha River in West Virginia and small populations may still be present in several other Ohio River basin streams and the mainstem Ohio River. Live individuals have been recently recorded from the Belleville and Racine pools (ESI 2000).

Fat pocketbook
There are numerous recent records for this species in the lower Ohio River, primarily from the Wabash River and downstream. This is a species of larger streams or rivers and prefers substrates of mixed sand, silt and clay. Its decline is believed to be related to extensive dredging and other activities that destabilize substrates. The freshwater drum is known to be able to serve as a host fish for the glochidia of the fat pocketbook.

Orangefoot pimpleback
The orangefoot pimpleback inhabits gravel substrate in medium to large rivers of the Ohio River basin. This species' distribution and reproductive capacity have also been impacted by the construction and operation of reservoirs, locks and dams, and by other impacts on water and substrate quality. In the Ohio River this species is currently found in the lowermost portion, most recently in the open river and pool 53. The best remaining populations occur in the Tennessee River in Alabama and Tennessee, especially downstream of Pickwick Landing Dam in Tennessee.

Pink mucket
The pink mucket is an Ohioan or Interior Basin species found in medium to large rivers, associated with moderate to fast flowing water and depths ranging from 0.5 to 8.0 meters (USFWS, 1985). Its habitats range from silt to boulders, rubble, gravel, and sand substrates (Hickman, 1937; Yokley, 1972; Buchanan, 1980; Clarke, 1982).

Historically, the species was widespread in distribution, occurring in at least 25 rivers (USFWS, 1985). It has always been considered as uncommon or rare. The reasons for the decline of this species are thought to be similar to most of our native mollusks including impoundment, siltation, and pollution. The pink mucket is presently known from about 16 different rivers representing three major geographic regions, one of which is the Tennessee/Cumberland/Ohio River System (USFWS, 1985). It is likely that this species still occurs in portions of the mainstem of the Ohio River. Recent records are known from the Belleville pool, R. C. Byrd pool, and Greenup pool (ESI 2000).

Ohio River Habitats of Concern

For the purposes of this FWCAR, we have considered the following as habitats of high quality importance:

- islands and backchannel areas
- floodplains (bottomland forest, riparian corridor, wetlands)
- tributary streams
- tailwaters
- wildlife refuges, natural areas or preserves
- prime migratory bird, waterfowl, and shorebird habitat
- gravel and/or sand bars and cobble substrates
- mussel assemblages
- embayments
- fish spawning sites
- colonial water bird rookeries/heronries
- threatened or endangered species habitat
- karst communities
- unique upland habitats

Several of these habitats of high quality importance, especially those habitats of particular significance in or along the Ohio River mainstem, are discussed in more detail below.

Islands

Since the locks and dams were constructed on the river, the dynamic forces that were responsible for creating islands within the mainstem Ohio River are no longer controlling. Many of the islands that previously existed are no longer present due to the impacts of inundation, dredging, sedimentation and erosion. The Ohio River Islands NWR compiled an assessment of the number and acreage of islands lost from the river since 1900 (Patty Morrison, personal communication). Historically, there were 124 islands in the Ohio River, comprising 25,291 acres. Since the 1911-1914 benchmark mapping by the Corps, 31 islands have been lost completely, and 10,906 acres (net loss) have disappeared from the terrestrial/wetland realm. The greatest percentage of lost island habitat occurred in the upper 300 miles, where 20 islands were lost. For example, in the early 1900's, there were 49 islands within the State of West Virginia's reach of the Ohio River (RM 40 to RM 317). Fourteen of these islands have been eliminated; one (Lesage Island) has been created; and two other islands are disappearing (Upper Sister and Bakers Islands) (Tolin and Schettig, 1983). Overall, the river has lost 43 percent of its historic island habitat, primarily due to dam construction (many of the high lift dams were built on islands), subsequent pool raises, and dredging. At the present time, 22 islands comprising 3,400 terrestrial and aquatic acres from river mile 35 to 397 are protected by the Ohio River Islands NWR.

For a number of the Ohio River islands, the habitats contain near natural assemblages of plants and animals native to the river, particularly when compared to the past and present use and development of the Ohio River and its floodplain. The often-complex interspersion of bottomland and riparian habitats and deep and shallow aquatic habitats make these areas extremely valuable to numerous fish and wildlife species. The deep and shallow water habitats associated with the islands are major fish and mussel production areas in the Ohio River. The

often-undisturbed island shorelines, especially the heads and back channels, are favored sport fishing areas. Back channels offer unique spawning and nursery habitat for a number of fish species and typically offer feeding areas for adult fish. The diversity of water depths, current patterns, and substrates and riparian cover provided by the islands provide habitats for large numbers of fish, macro invertebrates, waterfowl, shore and wading birds, and riparian furbearers.

The substrates associated with islands are largely a function of current velocity and pattern. Sand, gravel and cobble are predominant at island heads and in some back channels exposed to the thalweg or which naturally receive a great volume of river flow. With the exception of the dam tailwaters, the heads of the islands most closely resemble a natural run/riffle habitat.

Gravel/sand Bars and Cobble Substrates
Diversity in the topography of the river bottom is important in maintaining a diversity of plant and animal life. In shallow areas with swift waters, gravel beds and riffles provide habitat and spawning areas for many species. Where currents are slower, submerged and emergent vegetation becomes established and provides food and shelter for a different group of aquatic species. All sediment sizes have some habitat value for select species. For example, burrowing invertebrates prefer sandy bottoms and many filter feeding insects require a stable, hard substrate surface. However, the highest productivity and diversity of benthic organisms occurs in riffle habitats of medium cobble (approximately 150 mm in diameter) and gravel. Fine sediments or areas of continually shifting sands tend to reduce macro invertebrate species abundance and diversity, which may then affect fish species abundance and diversity.

It is likely that the most important effect of human environmental disturbance on the Ohio River fishes is the siltation and inundation of much of the original clean gravel or rubble substrate of the river bed. This coarse substrate provides lithophilic species of fish, which were the predominant type of fish in the historic Ohio River, with their preferred spawning substrate, which is now in short supply. When sediment deposition exceeds sediment transport, deposits of fine sediment can cover gravel bottoms that many organisms require for feeding and reproduction. When fine sediments smother these areas it reduces habitat quality and may result in the smothering of fish eggs and larvae.

Freshwater mussels are found in a variety of habitats ranging from mud and sand between bedrock ledges and boulders to rubble and gravel substrates. The majority of freshwater mussel species are typically found in riverine conditions in relatively firm rubble, gravel and sand substrates swept free of excessive siltation. These mussels are usually found buried in the substrate in shallow riffles and shoal areas. Persistent siltation of these areas has severely affected freshwater mussels. Mussel life cycles can also be affected indirectly by siltation by impacting host fish populations by smothering fish eggs or larvae, reducing food availability, or filling of interstitial spaces in gravel and rubble substrate, thus eliminating spawning beds and habitat critical to the survival of young fishes.

Floodplains, Bottomland Forest, Riparian Corridor, and Wetlands
Floodplains offer a number of different habitats and zones. These include constantly inundated channels and lakes, overflow riverine wetlands and dry uplands, which are infrequently inundated. Floods are the recurring feature of floodplains. Fish populations are dependent upon

the overflow areas for food production, feeding, spawning and rearing of young (Lambou, 1989). Floodplains can support extensive fish populations, depending upon water regimes, size of the river system, proximity to estuarine and marine waters, physical and chemical characteristics of the water and geographic location of the river basin.

The types of plants and animals found in oxbow marshes and backwater lakes are determined largely by the periodic flooding of these areas by the main river. Because this annual flood is a predictable and recurring phenomenon, many organisms have evolved adaptations that enable them to exploit the seasonally expanded habitat and the food brought in by the flood. Times of low water, however, are just as important as flooding. A low water level concentrates fish into shallow pools where herons and egrets obtain food for nestlings; it exposes mudflats where moist-soil plants grow and produce seeds sought by waterfowl; and it allows soils to drain and be exposed to oxygen, thereby speeding the processes of decay and the recycling of nutrients.

In the Ohio River floodplain, a typical habitat structure was a matrix of bottomland forest interspersed with components of other wetland types such as sloughs and oxbows. Much of this habitat has been drained and cleared for agricultural, leaving the remainder highly fragmented; however, several high quality natural areas remain. Regulation of the river for navigation has altered the height and frequency of water in these areas.

Wetlands formed by rivers are of several types, including oxbow marshes, floodplain bottomlands, and backwater lakes.

Marshes are highly productive habitats in which hundreds of species of birds, insects, and other wildlife spend most of their lives. Two factors account for the high productivity of marshes. One is the ability of marsh plants to capture large amounts of energy from the sun and transform and store much of it as chemical energy in the form of plant tissue. The other is the efficient recycling of nutrients already produced.

Forested wetlands are dominated by woody vegetation. They are differentiated into swamps or bottomland forest based on the duration of the presence of water. Swamps are forested areas in which the woody vegetation is 20 feet (6 m) or more in height and water is present on a permanent or semi-permanent basis; the woody vegetation is adapted to prolonged exposure to standing water. Forested swamps, once common in the southern Midwest, are often dominated by bald cypress and water tupelo. The soil in forested swamps may be either organic or mineral but usually has a topmost organic layer underlain with a mineral soil. Shrub swamps are similar to forested swamps except that less of the vegetation is in the form of trees. Typical plants include black willow, sandbar willow, buttonbush, swamp rose, and few species of dogwood growing in mostly mineral soils.

Bottomland or floodplain forests are temporarily or seasonally flooded areas that usually occur along streams and rivers. Because these forests are flooded frequently, they have a lower diversity of tree species than forests located on higher ground. The under story is typically open, and the ground cover is sometimes dominated by nettles. Rotting logs and woody debris deposited by floodwaters are abundant. Typical trees of midwestern floodplain forests are silver

maple, cottonwood, green ash, hackberry, and sycamore. Several oaks species can be found on terraces bordering floodplains. The soils that support these forests are usually mineral.

Year round pool retention by the Corps has adversely affected the species composition of the riparian forest. Where historically these areas would have had lower water levels during the growing season and high diversity of bottomland trees, there is now higher water levels and few tree species that can tolerate saturated root zones year round. For example, mast producing oaks and hickories are less tolerant and have been disappearing from the floodplain. Monocultures of silver maple now dominate the floodplain forest, with a resultant decline in habitat quality for floodplain forest dependent wildlife.

Bottomland forest overlaps broadly with wetlands. Some bottomland forest on alluvial soils is relatively well drained, and forest on floodplain terraces may be flooded only irregularly, however all bottomland forest types are of high value for wildlife. In most cases, historical wetland complexes along the Ohio River existed within a matrix of bottomland forest.

Significant wildlife use by wetlands and bottomland forest include the Indiana bat, bald eagle, copperbelly watersnake, several state-endangered species, furbearers, waterfowl, colonial wading birds, neotropical migrant songbirds, and a variety of reptiles and amphibians.

Embayments

Prior to impoundment, the Ohio River was a relatively shallow river with numerous islands, gravel bars, channel wetlands (riverine emergent, and riverine aquatic bed), and adjacent overflow sloughs surrounded by bottomland hardwood forests. Impoundment of the river for navigation interests created primarily deepwater habitat along the main channel corridor (average depth in channel 20–30 feet), with many islands, shallow bars, and channel wetlands consequently disappearing. Most of the remaining shallow water and wetlands in the floodplain occur in the embayments – the drowned tributary mouths inundated by backwaters from the impounded Ohio River.

In summer, during the height of the growing season, the diversity of wetland plants and habitat types provide excellent food and cover for migratory and resident wildlife. The shallow water habitats are important feeding areas for wading birds such as great blue herons, great egrets and black-crowned night herons, especially for those that nest in heronries nearby and feed in the embayments while raising their young. After fledging, juvenile herons concentrate in the embayments as well. Wood ducks, mallards, and Canada geese nest and raise their broods in the embayments and along the mainland wetlands in summer.

Young-of-the year fishes find shelter in the riverine aquatic bed and emergent wetlands. The embayments are important nursery areas for Ohio River fishes, particularly Centrarchids. The embayments also support an abundance of amphibians and reptiles (i.e., snapping turtles, spiny softshell turtles, painted turtles, map turtles, northern water snake, bull frog, leopard frog, green frog, pickerel frog, grey tree frog, spring peeper, fowler's toad, American toad), as well as at least 19 species of mussels.

Fall generally brings lower water levels in the embayments, exposing mudflats and invertebrates as well as aquatic plants to feed migrating shorebirds, wading birds and waterfowl. Native wildlife food plants such as smartweeds, bulrushes, wild rye and millet lie down and become available to migratory birds and other wildlife. Soft mast-producing trees and shrubs dominate in the embayments (elderberry, cherry, spicebush, hackberry, grape, dogwoods), providing abundant food for migratory landbirds en-route to their southern destinations.

During winter, the emergent wetland vegetation in the embayments lays down and dies back, but submerged aquatic vegetation and rootstocks remain as important food for wintering waterfowl and muskrat. While high water and swift currents are common on the main river in winter, the embayments provide quiet resting places off the main river for fish and wildlife. Over 25 species of waterfowl (ducks, geese, swans, mergansers) and other waterbirds (loons, grebes, and gulls) rest and feed in the embayments in winter as long as they remain ice-free. Bald eagles are more abundant in winter than at other times of the year along the Ohio River and in the embayments, as they shift south off frozen lakes and rivers in the north.

Spring comes to the embayments earlier than the main river, as the shallow waters warm up faster. Those bottomlands, which were flooded in winter "green up," and the exposed mudflats again nourish migrating shorebirds and wading birds. Herons and waterfowl begin to nest as early as March. Neotropical migratory landbirds also return to nest including warblers, thrushes, vireos, cuckoos, flycatchers, and tanagers. Many more species pass through on their journey back to their northern breeding range, stopping and feeding on late fruits, early seeds, and abundant insects.

Uplands

Upland forest is defined herein as all forest that is outside of floodplains and does not meet the definition of wetlands. Significant wildlife use of upland forests along the Ohio River includes the Indiana bat, gray bat, raptors (including bald eagle nesting) and neotropical migratory songbirds.

Tributary Rivers and Streams

There are numerous tributaries throughout the Ohio River system of importance, especially to fish and mussels resources. For example the Wabash River and its tributaries contain a major compliment of big river fishes, and may even contain healthier populations of some species (e.g. blue sucker, lake sturgeon) than the Ohio River; and the lower Tennessee River contains an extremely rich big river mussel and snail fauna. The issue of connectivity of these tributaries to the river is of concern.

VI. RESOURCE CONCERNS AND SERVICE RECOMMENDATIONS

The unusually rich and diverse fauna found in the Ohio River watershed is the product of a multitude of biotic and abiotic factors, which have evolved over time. Throughout geologic time, changes in such factors as topography, climate, and geomorphology have formed, modified, and eliminated habitats and consequently have had a profound effect upon the distribution of the floral and faunal assemblages in the watershed. Due to the watershed's central

geographical location in the eastern United States, some species with northern affinities and others with southern affinities occur in the watershed in addition to those common to the central region of the country.

Environmental alteration and degradation are continuing challenges to the maintenance of a productive and healthy watershed. Resources of the Ohio River watershed are threatened by land-use practices, direct and indirect physical alteration of the area's rivers and streams, acid mine drainage, destruction of wetland habitats, and both point- and nonpoint-source discharges of pollutants. Herbicides, insecticides, nutrients, and sediment are significant components of the agricultural runoff that adversely affect aquatic systems in the Ohio River watershed. Acid precipitation and other airborne pollutants are having effects on aquatic and terrestrial communities. Natural resources are further threatened by an expanding human population and its increased demand for both renewable and nonrenewable resources. Contamination of both aquatic and terrestrial systems through acid mine drainage and accidental release of toxic chemicals is a continuing threat. Continued operation and maintenance of the inland navigation system and the recent invasion of the non-indigenous zebra mussels are having significant adverse impacts on native flora and fauna of the watershed's rivers and streams. Other non-indigenous species are threatening native components of aquatic and terrestrial systems throughout the watershed. The expansion of urban and suburban areas within the Ohio River watershed and the concurrent loss of forest, wetlands, grasslands and other habitat types have reduced the quantity and quality of natural habitats available to fish and wildlife.

Although the Ohio River has been modified greatly, it still remains a national treasure, with a rich history of culture, commerce and natural resources. However, some of these natural resources are declining and/or their very existence is tenuous. Some are already gone forever, such as certain big river riffle species of freshwater mussels now considered extinct. Protection of Service trust resources (i.e., endangered and threatened species, migratory birds, interjurisdictional fisheries and Service lands) and conservation of these and other resources such as river shoals, backwaters, islands, etc., will require active human intervention to preserve, enhance, and sustain these resources and the healthy ecosystems on which they depend. This will require a more holistic view of resource conservation, recognizing that all resources are connected. To be effective, an ecosystem restoration approach will not only mean protecting or restoring the function, structure, and species composition of an ecosystem but also factoring in the impacts of and providing for sustainable socioeconomic activity.

Provided below are selected natural resources and topics of particular importance on the Ohio River. They are essentially 'riverine' in nature and/or connection to the Ohio River. Included in these assessments are recommendations to the Corps regarding each resource and topic. These are topics the Service believes are of highest priority. The Service strongly encourages the Corps to fully address each one at the earliest opportunity.

<u>The Quality and Quantity of Riverine habitat and the Connectivity of Riverine Habitat in the Mainstem and Tributaries</u>

Historically, the Ohio River contained long shallow riffle/shoal areas (such as the Falls of the Ohio) and wide, shallow backwater side channel wetlands and overflow channels/sloughs through the floodplains. These important habitats types were mostly lost when the river was

impounded. Islands, and other important habitat type, still remain, but there are fewer in number and many suffer from shoreline erosion and side channel sedimentation. Most tributary mouths have been converted by impoundment to embayment, usually of lesser quality than natural backwaters. Many of these are silted in through a combination of sediment input due to adjacent and upstream land use and navigation-related alterations in river flow regimes, which prevent or reduce natural flushing of sediments into the Ohio River mainstem.

The aquatic habitat, especially immediately downstream of the locks and dams on the Ohio River, still 'resembles somewhat' the former riverine nature of the Ohio River. The Service considers this remaining 'riverine' habitat as extremely important to the riverine fish and mollusk fauna in the Ohio River, serving as feeding and resting areas, permanent habitat for riverine fish and mollusks, staging areas for migrating fish, and contains spawning habitat. It is of the ultimate importance to maintain and/or enhance the sustainability of this riverine habitat throughout the river system. These riverine habitats are currently limited in quantity, quality, and connectivity. The pooled portions of the river create large distances that separate these remnant riverine habitats; and, the presence of the locks and dams increase the discreteness of these remnants, intensifying the need to provide connections to the aquatic fauna within and between each pooled portion of the river. The Corps has an opportunity and responsibility to preserve and enhance these habitats for the aquatic fauna, and to fund efforts and use various other means to connect these habitats to each other. This is also an opportunity for the Corps to work with and collaborate with state agencies, the Service, and others interested in improving this remaining riverine habitat and ultimately achieving a high quality of sustainability.

Recommendations:

1. Identify, describe, and quantify riverine habitat in the Ohio River mainstem and larger tributaries. This baseline information will help in future adaptive management and monitoring activities to determine progress on achieving sustainability. The Corps will need to work closely with state agencies, the Service, and others to jointly determine just what is the appropriate definition of 'riverine' habitat throughout the mainstem. This may vary depending upon the particular aquatic resource and may encompass more than the discrete tailwaters below the dams. Maintaining a high quality of existing riverine habitat, along with the ability of the Corps to improve the quantity and quality of this habitat, will be crucial towards achieving any environmental sustainability of the natural resources of the Ohio River.

2. Restore connectivity between the riverine portions of the mainstem river, and between riverine mainstem sections and the larger tributaries; and, enhance stream habitat quality in the lower reaches of tributaries. It may not be possible to achieve complete 'natural connectivity' for all aquatic resources. For certain resources and/or species it may require a long-term commitment from the Corps to seek and obtain funding of 'active human intervention' to create connections and sustain certain resources at desirable levels. For example, this could involve the Corps working closely with state agencies, the Service, and others to fund propagation of mussels and/or riverine and interjurisdictional fishes to create, enhance, and/or maintain populations in appropriate riverine habitat.

3. Preserve natural spawning shoals, and create artificial shoals (e.g., gravel shoals) at appropriate locations, which do not interfere with navigation. Incorporate into the project design the creation of shoals using material generated by the proposed activity or obtained elsewhere. Other artificial structures can be used to create structural habitat, cover and low-velocity areas.

4. Create vegetated shallows both in the mainstem Ohio River and in selected embayments through vegetation planting and construction of shallow protective dikes (if necessary). These habitat types are used by several fish species for spawning and nursery areas. They are also used by waterfowl and wading birds.

5. Stabilize eroding shorelines on the riverbank and on islands. Where conditions permit, stabilization of eroding shorelines by a combination of armoring, removal of submerged dikes (where appropriate), longitudinal dikes set parallel to eroding shorelines, tree plantings and other techniques (e.g., bio-engineering) can substantially reduce the silt load of the river. Several potential project locations exist on the Ohio River and its tributaries and on islands within the Ohio River.

6. The Corps should incorporate and maintain large woody material (i.e. large trees, snags) at selected sites (side channels, islands, etc.) especially in the 'more riverine' portions of the pools. Snags and large woody material were a prominent element of the river prior to the Corps efforts to remove this material to improve navigation. Replacing some of this large woody material may require a research component and adaptive management to determine the appropriate locations and amount of such woody material. However, the Service believes that the creation of this kind of woody habitat will benefit numerous aquatic resources, and can be done without negatively impacting navigation on the river.

Stream Habitat Quality in the Lower Reaches of Tributary Mouths:
Tributary mouths have been transformed by impoundment from stream environments to lake-like environments, often for several miles of the stream's lower reaches. Many embayments have silted in due to soil runoff and lack of flow velocity resulting from impoundment.

Recommendations:

1. Restore embayments and enhance their connectivity to the river. This could include dredging of heavily silted embayment entrances and creation or expansion of deep-water areas. Deepening access to portions of heavily silted embayments, provides an important component of connectivity to riverine habitat.

2. Enhance stream habitat quality in the lower reaches of tributary mouths.

3. Reforest the lower reaches of tributaries as a means of reducing siltation of embayments and of creating valuable wildlife habitat.

4. Consider placing wing dikes or similar structures to concentrate flows in sub-channels at the lower end of tributaries to keep channel deeper and free of accumulated sediment.

5. Restore or enhance wetlands in the upper ends of tributary embayments as a means of reducing siltation and creating valuable fish and wildlife habitat.

6. Restore or enhance embayment values to fishery resources by selective dredging of accumulated sediments.

Freshwater (Unionid) Mussel and Snail Fauna:
Native mussel populations in the Ohio River have experienced severe declines and were identified in early study planning by the Corps and the Interagency Working Group (IWG) as an important topic to be addressed in the PEIS. Refer to the chapter on mussels in this PEIS for the Corps historical, current, and CEA assessment on this fauna; and, for important references in the citation section. In addition to the Corps, the Service and state representatives participating on the IWG also provided input and reviewed of the mussel chapter. The term 'mollusk' fauna is used herein to refer to those appropriate situations involving both the mussel and snail fauna.

The riverine snail fauna of the Ohio River has also experienced drastic declines similar to the mussel resource. The Service encourages the Corps to consider the snail fauna as an important component of the mollusk fauna; however, the Service believes that habitat improvements done for the mussel resource alone will also greatly benefit the snail fauna.

The mussel fauna is a key biological indicator of the overall condition of the river and as such is useful as a measure of progress regarding the river's environmental sustainability. The Service considers the mussel resource of utmost importance, especially since this resource is influenced tremendously by the fish fauna, fish passage through locks and dams, aquatic habitat conditions downstream of locks and dams, navigation traffic, lock and dam construction and operation, dredging/disposal activities, water dependent industry development on shore, invasive species, long pool reaches, and other factors.

While the Service recognizes the Corps has varying levels of involvement and/or influence regarding achieving a high level of environmental sustainability for mollusks, the Corps must consider, as shown in this ORMSS PEIS, how its past, present and future activities interconnect with other factors impacting the mollusk resource. The construction of the dams and the maintenance of the navigation pools creating year round slackwater habitat, have created unsuitable and /or marginal conditions for mollusk sustainability throughout much of the Ohio River. This alone likely complicates and may actually prevent any long-term high quality environmental sustainability of the mollusk resource. Certain big river riffle species of mussels are extinct and/or extirpated from the river because their habitat has been eliminated. No species of snail has yet been known to become extinct in the Ohio River; however, the riverine snail fauna has drastically declined to such an extent that it currently exists as only a remnant of its pre-dam fauna. Only small portions of the Ohio River mainstem still 'resemble somewhat' the riverine conditions prior to dam construction, or even the 'wicket dam era', when dams were more numerous but their height was lower. The loss and/or diminishment of long stretches of former riverine habitat, is made more acute by the recent trend toward higher dams, and is likely

contributing to an increasing isolation of mollusk assemblages throughout the mainstem. The ability of a mussel species fish host to move through these long stretches of pools is not well known, but likely varies greatly depending upon the species and time of year (water levels).

The Service recognizes that water quality in the Ohio River has generally improved sufficiently to allow nascent recolonization of certain species of mollusks. For example, certain species of mussels are again present in the upper portion of the Ohio River, an area in which the mollusk fauna was negatively impacted the most by historic water quality conditions. There are many factors that can prevent or setback water quality improvement, but if improvement continues it is likely the mollusk fauna will respond positively and improve in the direction of increased sustainability, at least in certain river reaches or pools.

The Corps has an opportunity in this ORMSS PEIS, regarding future projects on the Ohio River, to provide vigorous positive leadership and produce results regarding its role in incorporating actions that will benefit the mollusk resource. The Service currently believes the Corps assessment of the overall mollusk resource as 'marginally sustainable' is a best case scenario only for certain mussel species. Much of the mussel resource is not sustainable under the recent past, present, and foreseeable future. This resource will continue to require proactive management by the Corps and others interested in maintaining and improving this fauna to a level of marginal sustainability.

The primary causative factor in the decline and present endangered status of freshwater mussel species is loss of habitat. A lot of historic diversity is gone from the river because of loss of habitat, especially for the big river riffle-dependent species; however, some species are gone from the river (especially the upper river) because of historic water quality problems, and now that water quality is suitable again, they may have difficulty coming back on their own because Corps dams separate the habitat from existing reproducing populations many pools away (or up into tributaries). Active restoration (stocking adults and juveniles) would help these species. A number of agencies are presently working to develop techniques for artificial propagation of mussels. However, successful propagation of mussels in laboratories will not contribute to the recovery of species unless there is suitable protected habitat available in which to place them.

Recommendations:

1. Avoid and/or minimize additional loss of riverine mollusk habitat. The Corps should address this issue collaboratively with state agencies, the Service and others. This issue is closely aligned with the earlier discussion regarding riverine habitat and highlights opportunities the Corps can take to benefit multiple aquatic resources through certain actions. The status or sustainability of mollusk habitat is an issue that will vary in different reaches of the river. It is important to establish an early assessment of this habitat with other partners (i.e., state agencies, Service, others) in order to best describe this baseline of mollusk habitat, and to set river reach and/or pool priorities in order to obtain the greatest benefit for the mollusk resource.

2. The Corps should institute a "no more net loss" of mussel habitat in the river; and Corps sanctioned or permitted water dependent development which could result in additional

losses of riverine habitat, which is already reduced, should require habitat improvements elsewhere.

3. The Corps should make every effort that is reasonable and possible to improve the environmental sustainability of the mollusk resource to a high level of sustainability throughout the entire mainstem of the Ohio River, including larger tributaries.

4. The Corps should support and fund the gathering of baseline information on mollusk populations throughout the Ohio River. This should include mollusk surveys and long-term trend monitoring of the mollusk resource.

5. The Corps should continue to investigate the feasibility of creating mussel habitat in the Ohio River and/or in the lower reaches of its tributaries in areas that presently or historically supported mussel populations. The possibility of creating side channels with continuous flow and suitable substrate below existing dams, or creating artificial "islands" with back chutes, should be explored.

6. Restore native mussel populations in the Ohio River and reintroduce extirpated species where habitat is suitable and fish hosts are now present or can be reintroduced themselves.

7. The Corps should support and fund specific studies to determine how barge fleeting areas impact the mollusk resource. In addition, areas of mollusk assemblages can be identified at which no fleeting activity is permitted; and/or, areas specifically set aside to contain necessary fleeting activities.

8. The Corps should provide funding to determine fish hosts for those mussel species in the Ohio River for which hosts are not currently known.

9. The Corps should support and provide adequate funding to mollusk propagation facilities (e.g. Kentucky's Center for Mollusk Conservation, Columbus Zoo/OSU facility, White Sulphur Springs facility, and etc.) to enhance mollusk assemblages and reintroduce rare and historic species to appropriate locations in the Ohio River. Active human intervention regarding mollusk propagation will likely be needed for the foreseeable future.

10. The Corps should restore connectivity of mainstem mussel populations to each other and to tributary populations. This will most likely involve working with identified host fish and insuring they are able to access separate mussel assemblages both within and between pools. This may also involve active human intervention in the form of infecting and transporting fish hosts from one location to other locations.

11. Restore mobility of fish hosts through the dams at the appropriate times of year needed for mussel reproduction. This is discussed in more detail in the following fish passage section.

Fish Fauna and Fish Passage:
The fish fauna of the Ohio River is still relatively diverse; however, certain riverine and/or migratory species are not present, exist in very low numbers (e.g. sturgeon), and/or occur in sparse distribution in the river. For certain fish species connectivity between populations is problematic and will require proactive intervention.

Fish passage was recognized as an important issue of concern for special attention very early during the ORMSS Interagency Working Group meetings and discussion. The IWG provided suggestions to the Corps for specific studies to help address questions concerning fish passage on the Ohio River. The studies and reports funded by the Corps as part of the ORMSS attempt to address several aspects of fish passage issues and possibilities. Although the reports may not be as complete and/or conclusive as desirable, the Service believes the reports, as a whole, do provide additional information regarding fish passage that is useful in determining higher priority lock and dam facilities in need of improved fish passage opportunities. Based on these recent studies and other information, the Service believes that the upper portion of the Ohio River is experiencing the greatest impediment to fish passage from the locks and dams; and, that other 'higher' dams in the downstream portion also greatly impede fish passage. The downstream portion of the Ohio River is experiencing fish passage problems; however, these problems do not seem to be as acute as in the upstream portion of the river. Please refer to the chapter on fish passage in the CEA portion of the ORMSS PEIS for more detailed information on the Corps funded studies. Selected members of the IWG provided input during the formation of these studies and review of the reports. The Corps is to be commended for conducting these studies; however, there is still additional specific studies that are needed to complement those already done, and to address additional questions or concerns developed during the recently conducted studies.

There are essentially two possibilities for fish to move on their own from downstream to upstream of a particular lock and dam. Passage can occur through the lock either during a normal lockage event or a lockage specifically designed to encourage and allow fish to pass; or, fish can circumvent and/or swim over the lock and dam. The later method is complicated by the height of dams, frequency of water levels sufficient to allow fish to circumvent or pass over the dam, velocity of flow through gates and over the upper surfaces of the dam. In addition, it is very important that the timing of passage opportunities and the desire of fish to migrate occur simultaneously. The impulse to migrate or move varies with fish species and for some species is not well defined or understood.

Fish passage is also intricately linked to mussel fauna sustainability. A portion of a freshwater mussels life cycle requires the partially developed young to attach to a fish host after leaving the female mussel. Certain mussels are very fish species specific in their host requirement. It is extremely important that the appropriate fish host for a mussel be present in sufficient numbers when larval mussels are released from the female mussel. Mussels need the fish host to be able to move freely when they are infested with mussel larvae, which is generally spring through fall for most species of mussels. Even though the lower river reaches experience passable water conditions for fish more often than the upper portion of the river, the ability of the fish to move over mussel beds and disperse during the right time of year for the mussels is still impaired in the

lower river. For the greatest benefit to the mussel resource, the timing of fish passage for a particular fish host is critical.

The Service does not believe that concerns about invasive fish species using fish passage improvements should hinder or prevent the Corps from vigorously installing fish passage. The Service believes that the invasive fish species will be able to access the entire river system regardless of improved fish passage; and, that at the very best, the current locks and dams will only slow somewhat this invasion.

Dams prevent migratory/highly mobile species (e.g., paddlefish, sturgeon, blue suckers, and etc.) from moving freely throughout the river to exploit the variety of habitats necessary for different parts of their life cycles, and isolate mussel populations in the various pools from each other. Recently completed ORMSS fish studies indicate lock chambers are apparently not used extensively by fish to move from pool to pool. There may be times when the lock chambers and high flows facilitate fish passage to some extent; however, their operation is generally not designed to facilitate fish passage, and passage may not be available at critical times in the life cycles of migratory fishes. In addition, freshwater mussels have an obligate parasitic stage during which they are attached to the gills of a specific host species of fish. These mussel species are dependent on their host fish for early development and dispersal throughout their natural range. If host fishes are prevented from moving upstream or downstream during critical life stages of mussel reproduction and development, then this mechanism of development and dispersal is disrupted.

Recommendations:

1. Improve riverine habitat conditions downstream of locks and dams to maximize spawning, feeding, resting, and over wintering opportunities for fish.

2. Restore connectivity between various habitats utilized by riverine fishes.

3. Support and fund efforts to restore fish, especially the more riverine species (e.g., sturgeon, paddlefish, blue sucker, etc.) to appropriate locations throughout the river and in the larger tributaries.

4. Create, restore, and maintain velocity shelters in the river using either natural or man-made materials, especially including habitat sites fish will use during winter.

5. Create opportunities for adequate fish passage at all locks and dams on the mainstem Ohio River in order to improve connectivity between fish populations and mussel assemblages throughout the river. This will likely require construction of appropriate fish ladders and/or artificial streams circumventing the dams at most if not all such facilities. To place such fish passage structures at every lock and dam facility, the Corps will likely need to obtain special funding; however, the Corps could incorporate fish passage into expected large-scale improvements such as the replacement of locks (e.g. Emsworth, Dashields, and Montgomery Locks and Dams). The Corps should work closely with state agencies and the Service (e.g., Interagency Working Group) to

determine how this effort should be prioritized. Based on the Corps fish studies it appears to be more acute in the upper portion of the river and the Service believes the locks and dams in the upper portion of the river; and, higher dams throughout the system should receive priority for this action.

6. The Corps should evaluate the feasibility of improving fish passage through locks by incorporating techniques to encourage fish to enter locks and 'lock through' during normal lockages.

7. The Corps should evaluate the feasibility of utilizing lockages specifically designed to provide increased opportunities for fish to pass through the locks, and/or other adaptive management and active intervention to facilitate fish passage.

8. Modify lock chamber management to facilitate fish passage at key times, such as during paddlefish spawning migrations.

9. When replacing or adding additional filling capacity to a lock consider replacing the existing open/close valve with one that would allow partial flow to enter the chamber. This would allow flow to enter during "dummy lockages" – i.e., leaving the lower lock gates open for a fixed period of time with valves cracked open to provide an attracting flow within the open chamber. The lower gates would then be closed and the trapped fish locked upstream to the next pool.

Navigation Impacts:

Of special concern are the physical impacts and pollution from navigation activities on the Ohio River, primarily barge traffic and barge fleeting/loading and unloading facilities. These activities would not exist to such a vigorous extent without the Corps maintenance of a navigable channel. The Service has found that it has been difficult and frustrating to get consensus on who is responsible for these kinds of activities. The Service believes that the Corps and Coast Guard should both be accepting more responsibility for these activities; however, we believe both agencies tend to disclaim responsibility or place it on the other agency. This problem must be resolved in a collaborative manner if we are to develop, preserve, protect, and enhance riverine resources, especially riverine habitat, island preservation, mollusks, and riverine fish fauna.

The Service reminds the Corps of the responsibility they have under the FWCA to provide that wildlife conservation shall receive equal consideration of importance as maintaining a viable navigation system. To do this, we believe there are a number of questions that will need to be answered: What does 'equal consideration of importance' really mean? Has the level of a 'viable' navigation system been reached relative to, and at the expense of, wildlife conservation? We believe the Corps has the responsibility to determine and quantify this. The Service believes that currently the navigation system could be considered more viable than the natural resources (i.e., wildlife conservation), especially 'riverine' resources. We are willing to collaborate proactively with the Corps to discuss and move forward on this issue.

There are extensive barge fleeting areas along the Ohio River shoreline, many associated with electrical generating stations (coal), coal production, producers of rock and gravel products, and

commercial ports. Since most fleeting is in relatively shallow shoreline areas, substantial impacts may occur to mussel assemblages and shoreline fish spawning habitat when these fleeting areas are developed and dredged, particularly if the facility is sited over a mussel assemblage. Physical impacts of tow traffic are intensified around these areas. Impacts on mussels from towboat scour and barge groundings can be magnified in queuing areas. Recent information from individuals propagating juvenile mussels indicates that light levels may play an important role in juvenile development. It is possible that barge fleeting may negatively impact mussels by the shade created from the fleeted barges.

The impacts of navigation traffic on aquatic biota is a subject that has been studied extensively by the Corps and others (Gloman, 1984; Miller et al., 1997). The types of impacts have been identified, however the extent of impacts has not been extensively analyzed. The extent of impacts is probably dependent upon such factors as season, flow stage, and local conditions. In general, impacts include entrainment of planktonic and mid-water eggs and larvae through propellers, shoreline erosion and disruption of shoreline fish nesting by barge wakes, displacement of fish from shelter areas during winter, scouring of benthic habitat, siltation on mussels and other benthic biota, spills of pollutants from barges and loading docks, and direct physical impacts of barges and propeller thrust on benthic biota, especially mussels.

At present, aquatic resources are being adversely affected by navigation on the Ohio River. Aquatic organisms may be impacted whenever barge traffic occurs in water shallow enough that bottom substrates and benthic organisms (especially unionid mussels) are disturbed by propeller scouring, barge wakes and barge groundings (Gloman 1984, Miller et al. 1997, Rasmussen 1983, Corps 1997). These impacts may be magnified during queuing of barges waiting for lock passage, which typically occurs in shallow water. Barge fleeting areas cause similar but greater long-term adverse impacts due to the greater concentration of aquatic species in shallow water and shoreline areas (Gloman 1984). Additionally, benthic organisms may be adversely affected by instream disposal of spoil from maintenance dredging, particularly in the lower Ohio River, where dredging is more frequent. And, the short-term fluctuations in water level resulting from barge wakes may affect fish nesting success in shallow water shoreline areas.

Recommendations:

1. The Corps should take a lead role in bringing together appropriate parties to discuss problems and solutions to the impacts of navigation activities to natural resources, and continue to fund needed studies that result from such discussions and collaboration.

2. The Corps should take a lead role in determining the compatibility of navigation related activities and natural resource needs, and to determine and quantify what is equal consideration of wildlife conservation and maintenance of a viable navigation system, and how it should be achieved. Determinations of 'marginally sustainable' (e.g., mussel resource, riparian/floodplain resources) indicate a need for a more proactive role by the Corps in giving these resources, and perhaps others, 'equal consideration'.

3. The Corps should work with the navigation industry, Coast Guard, and others to minimize physical impacts and pollution from barge traffic and barge fleeting.

4. Under the ORMSS PEIS With Project Conditions, the Corps proposed to use a mixture of structural improvements, operational measures, and maintenance alternatives as presented in the SIP/PEIS to determine appropriate actions at their facilities. The Service is concerned that the issue of queuing of barge tows, especially when tows are positioned near mussel assemblages. We especially urge the Corps to address this issue to ensure that negative impacts to mussel resources do not occur due to queuing.

5. To conserve mussel and other aquatic resources and riparian habitats, install mooring cells or buoys at critical locations where barges temporarily moor over mussel beds or against the shoreline.

6. Create additional velocity shelter structures in the mainstem for fish to utilize, especially needed during winter periods for all age classes and as nursery habitat post-spawning, to protect fish from velocities and turbulence caused by towboat wakes.

7. Work with the commercial navigation industry to conserve fish and wildlife resources by providing charts showing the location of mussel assemblages and other sensitive resources, with information concerning why these resources should be avoided.

8. Work with industry and the Coast Guard, as well as the Federal and state fish and wildlife agencies, to install channel markers/navigation markers, if appropriate, around shallow water mussel assemblages and other sensitive areas to reduce direct impacts of tow traffic to fish and wildlife resources.

9. Use adaptive management regarding the need to dredge the navigation channel. We encourage the Corps to dredge only when absolutely necessary. The Corps is encouraged to continue and improve upon its communications with the Service and state agencies regarding dredging issues.

10. Consider flow-concentrating structures to prevent sediment from building up at approaches to the locks and dams or other long-term problem areas. Also, develop alternatives to instream disposal of dredged materials (upland sites, island creation, use for bank stabilization by filling behind dikes, etc.).

11. Install mooring cells or buoys at critical locations where barges temporarily moor over mussel assemblages, in order to protect mussel and other aquatic resources and riparian habitats.

12. Minimize physical impacts and pollution from barge traffic and barge fleeting, dredging and disposal, and other navigation related activities on the river that may negatively impact the natural resources. This might entail various actions including strategic placement of dredge spoil.

Islands, Back Channels, Side Channels and associated Habitat Conditions:
These kinds of habitat and their quality, quantity, and location within a pool and/or reach of river are extremely important to the fish and mollusk fauna. Their connectivity to the river is essential if the aquatic fauna is to utilize these habitats at critical time during their life cycle.

Recommendations:

1. Determine which pools and/or reaches of river require enhancement of these types of habitat, and which sites should receive the highest priority for improvement.

2. Restore and enhance as much as possible throughout the Ohio River and its larger tributaries, and especially in the more riverine habitat and its components, islands, backwaters and side channels, substrate and flow conditions which meet all life stage requirements for native mussels and riverine fishes, including interjurisdictional fishes and endangered species, appropriate flow regimes for optimal water quality for fish and wildlife, snags and/or other large woody structure, and etc.

3. Improve habitat conditions in side and back channels in pools in which significant amounts of silt have accumulated. Provide additional flow as needed into these channels while still maintaining backwater environments.

4. Protect existing islands by appropriate methods (managing flow, bioengineering, rock, etc.), and also create islands, both permanent and temporal, throughout the river.

5. Use dredge material, if it is appropriate, to enhance and/or create habitat for mussels, fish, and other vertebrates and invertebrates. This could include the creation of islands and/or diversification of habitats for various aquatic species. This has already been done in some portions of the lower river e.g., sand islands for interior least terns. Dredged material could also be used to create shallow water habitats, especially vegetated shallows, which could also be called riverine wetlands.

6. The Corps should incorporate and maintain large woody material (i.e. large trees, snags) at selected sites (side channels, islands, etc.) especially in the 'more riverine' portions of the pools. Snags and large woody material were a prominent element of the river prior to the Corps efforts to remove this material to improve navigation. Replacing some of this large woody material may require a research component and adaptive management to determine the appropriate locations and amount of such woody material. However, the Service believes that the creation of this kind of woody habitat will benefit numerous aquatic resources, and can be done without negatively impacting navigation on the river.

Flood Plains - Bottomland Forest, Wetlands, and Riparian Corridor:
In the Ohio River floodplain, a typical habitat structure was a matrix of bottomland forest interspersed with components of other wetland types such as sloughs and oxbows. Much of this habitat has been drained and cleared for agriculture, leaving the remainder highly fragmented; however, several high-quality natural areas remain.

Recommendations:

1. The Service recommends the Corps restore and enhance as much as possible the riparian forest, bottomland forest and wetlands along with their functions and connectivity to the river, throughout the Ohio River and the lower portions of tributaries, including their embayments.

2. Restore and/or create as much as practicable floodplain wetlands (palustrine emergent, scrub-shrub and forested) and their connections to the river during high flow periods via sloughs and overflow channels.

3. Investigate seasonal water level management to enhance channel wetlands and increase survival of less water tolerant floodplain trees. Try to mimic the seasonal highs and lows of the natural water cycle.

4. Re-establish, by active planting, a diverse complement of bottomland hardwood trees species needed by floodplain dependent wildlife, e.g., cottonwood, sycamore, swamp white oak, green ash, sweet gum, hackberry, American elm, Kentucky coffee tree, shagbark hickory, shellbark hickory, pignut hickory, river birch, butternut, black willow, pecan, pin oak, shumard oak, including a mix of standing dead trees and snags. Manage the understory for appropriate native shrubs such as pawpaw, spicebush, and dogwoods.

5. Consider increasing the elevation of selected low-lying areas adjacent to the river or create higher island habitats (above the static pool level) to promote forest growth. For more information on this see Ulrich *et al.* 2002.

6. Restore bottomland forest and riparian forest as a means of increasing fish and wildlife habitat and reducing habitat fragmentation.

7. Connect existing fragments of bottomland forest and riparian forest by creating corridors of floodplain forest minimum of 100 meters wide; as a condition of all Corps permitted activities (Section 10 and 404) along the river.

8. Require an appropriate minimum buffer strip of intact riparian habitat be maintained.

9. Re-connect floodplain wetlands to the river by restoring overflow channels and sloughs, which connect to the river during normal high water events.

Invasive Species:
It is expected that the native mollusk fauna will continue to be negatively impacted from invasive species for the foreseeable future. The Asian clam is present throughout the river system and likely plays a role in competing for resources (e.g. food, space) with native mollusks, and may negatively impact the reproductive success of native mussels somewhat through its filtering capacity; however, it does not seem to have the evident negative impact that the zebra mussel has demonstrated. It remains to be determined if the native mollusk fauna and zebra mussel presence will be able to coexist at a level which permits the native fauna to reach some

high level of sustainability. Another invasive species with potential ramifications to the mollusk fauna is the black carp. The black carp is one of several Asian carp present in the Mississippi River basin. It feeds primarily on small mollusks, so if it becomes a significant portion of the Ohio River fish fauna its impact could be devastating on the native mollusk fauna. It was recorded close to the mouth of the Ohio River in March of 2003 in Horseshoe Lake in southern Illinois. Other species of Asian carp (e.g. bighead, silver) have been documented, by fisheries biologists working in the Mississippi River, as becoming the dominant fish in their preferred habitat. These species are present in the lower reaches of the Ohio River upstream to McAlpine Lock and Dam (silver carp) and Markland Lock and Dam (bighead) (personal communications, Doug Henley, KDFWR). Their impact on the native fish fauna in the Ohio River is yet to be determined.

Recommendations:

1. The Corps support and fund trend monitoring of zebra mussels throughout the Ohio River. This is needed to not only monitor zebra mussels but to obtain information regarding their impact on other aquatic fauna, especially mollusks and fish.

2. Explore using controlled releases from tributary reservoirs and navigation dams to flush zebra mussel veligers from the river system at appropriate times of the year, thereby minimizing their ability to settle out and colonize the river substrate and native mollusk fauna.

3. The Corps address how its facilities, actions, and related navigation barge traffic, have influenced the presence of invasive species, especially the zebra mussel; and, determine and implement solutions to minimize the impacts of invasive species to the native fauna. This could include evaluating the efficacy of cleaning vessels to prevent re-introductions of zebra mussels from downstream and/or between pools, or other means to minimize impacts.

4. Explore what can be done to inhibit or prevent the black carp from becoming established in the Ohio River.

5. Control problematic invasive exotic plants on existing Corps lands along the Ohio River.

VII. SUMMARY OF FINDINGS AND SERVICE POSITION

As a Federal agency, the Corps has the responsibility to minimize negative impacts to fish and wildlife resources resulting from the construction, operation, and maintenance of the navigation system on the Ohio River. The Service expects the Corps to make every effort to avoid, minimize, and/or compensate regarding any mitigation that may occur regarding trust resources. We also believe the Corps has the responsibility to create conditions in which these riverine resources can be enhanced, recovered, and sustained, throughout the river, especially in those portions still with 'riverine' characteristics. The Corps needs to fully acknowledge the negative impacts to the Ohio River due to its navigation system on the Ohio River. These impacts have

diminished greatly the riverine nature of the Ohio River and the fish and wildlife resources. As long as these negative impacts resulting from the navigation system remain, the Corps, working with state agencies, the Service, and others, will need to support and fund efforts, not only to minimize negative impacts, but provide proactive adaptive management for the fish and wildlife resources for the foreseeable future. Corps responsibility includes taking the lead in finding appropriate funds to achieve environmental sustainability of the riverine fish and wildlife resources in the Ohio River.

The U.S. Fish and Wildlife Service (Service) fully supports the concept of a river-wide long-term assessment of needs and the effects of proposed changes on the system's natural resources. The Service recognizes the limitations and challenges the navigation system imposes on the fish and wildlife resources. The Service's desire is to work with the Corps, state agencies, and others to protect, enhance, and maintain the fish and wildlife resources and their habitat which remains, and increase the quantity and quality of these resources to the greatest extent possible.

The Corps has also undertaken another study, in cooperation with the Service and the states of Illinois, Indiana, Ohio, Kentucky, West Virginia and Pennsylvania, for the development and implementation of an Ohio River Ecosystem Restoration Project Partnership program, a large-scale ecosystem restoration initiative. The program would partner with non-Federal entities to restore, enhance, and protect fish and wildlife abundance, diversity, and habitats within the Ohio River watershed. This project is currently languishing primarily for lack of funding. We recommend the Corps make efforts to reinvigorate this project. A major impediment to implementation, if funded, is the current cost-share percentage of 65 percent federal and 35 percent state. The Service offers the following suggestions that we believe will allow the program to proceed and meet its objectives:

1. Cost sharing will not be required for projects conducted on federal lands.

2. Project Planning and Design should be 100 percent federally funded.

3. Minimal cost-sharing (i.e., 10 percent) should be implemented for state and other conservation partners.

4. Block grants may be given to state agencies to administer for project design and construction.

5. The Corps should work with, at a minimum, the Service and State fish and wildlife agencies to develop specific goals for the restoration program, and these goals should incorporate the goals of other ecosystem based fish and wildlife conservation plans.

6. A long-term monitoring program should be implemented to gauge the success of specific projects and the success of the program.

Previous Ohio River related FWCA Reports have usually been a result of specific Corps projects, and detail efforts that the Corps takes to mitigate impacts, regarding the fish and wildlife resources, near the actual site of the project. It is the intention of this FWCA Report to

direct the Corps to look at the entire river system and consider recommendations contained herein, not only when specific projects are considered, funded and constructed; but also to encourage the Corps to take a proactive approach and implement these measures and recommendations as specially funded projects.

The Fish and Wildlife Coordination Act directs the Corps to incorporate into project plans such justifiable means and measures for wildlife purposes as the Corps finds should be adopted to obtain maximum overall project benefits. The Service recommends proactive direct action by the Corps (e.g., fish passage via ladders or artificial streams around dams; connectivity of riverine habitats, propagation of juvenile mussels for transplanting to selected locations; fish stocking; island creation; improving habitat conditions downstream of locks and dams; restoring snags along shorelines; and etc.), in order to provide conditions to achieve the greatest fish and wildlife resource sustainability. Adaptive management, adaptive monitoring, and input and cooperation among the Corps and its partners (i.e. Federal, State, NGOs, and private entities), will be crucial in order to make progress and to determine if such progress will achieve environmental sustainability.

The National Environmental Policy Act directs federal agencies to undergo a "big picture" analysis. This analysis is necessary to avoid the potential cumulative impact problems that may go unnoticed in projects that are segmented into interdependent components. The Senate Report that accompanied NEPA states that "Important decisions concerning the use and the shape of man's future environment continue to be made in small but steady increments which perpetuate rather than avoid the recognized mistakes of previous decades." Senate Report No. 91-269, 91st Cong. 1st Session. 5 (1969). A federal agency's compliance with NEPA should help to avoid these mistakes. This Programmatic Environmental Impact Statement is an important step in that direction.

The Service believes the Corps should also view this ORMSS PEIS as the beginning of a process that will include adaptive management, adaptive monitoring, and input from others regarding fish and wildlife issues. The Corps has an opportunity, regarding future projects on the Ohio River, to provide vigorous positive leadership and produce results regarding its role in incorporating actions that will benefit the fish and wildlife resources.

One positive result of the Ohio River Mainstem Systems Study (ORMSS) was the formation and active involvement of the members of the Interagency Working Group (IWG). The Corps is commended for persistently encouraging this group to meet and discuss a variety of issues, and be involved in the ORMSS process. In addition, the Corps has worked with state agencies and the Service in order to make positive progress in the area of maintenance dredging activities in the river. The Louisville and Huntington Corps Districts continue to work with the states and the Service to refine and improve communication and to minimize negative impacts of dredging to the fish and wildlife resources. The Service believes these are good examples of team involvement and that the Corps should continue these team efforts and provides appropriate financial support so that team members will be able to participate to the fullest extent possible. Additional opportunities remain to work with the states, the Service, and others to improve existing conditions and impacts from operation of the navigation system. There is a need to establish designated fleeting areas that will not impact freshwater mussel assemblages or

sensitive fish habitat, etc.; and, the need to protect known sensitive areas such as fish spawning habitat, fish wintering habitat, mussel assemblages, and etc., from barge traffic impacts.

There remains the continued need for additional research, studies, management, monitoring, etc., to be done in order to more fully understand, how the fish and wildlife resources can become as sustainable as possible given the locks and dams and navigation constraints the resource has to deal with. The Service recognizes the Corps does not have the responsibility and/or ability to eliminate and/or fix all problems impacting the fish and wildlife resource in the Ohio River (e.g. water pollution, preventing erosion of uplands, and etc.); however, the Corps needs to recognize that once those impacts (e.g. water pollution, sedimentation, etc.) are in the Ohio River mainstem, the presence of the locks and dams, pools, etc., influence their impact on the resource; and, are likely to impact the level of success of resource environmental sustainability.

For further discussion please contact Leroy Koch at the USFWS Kentucky Ecological Service's Field Office (502) 695-0468.

VIII. LITERATURE CITED

Barbour, R.W. and W.H. Davis. 1996. Bats of America. Univ. Kentucky Press, Lexington. 286 pp.

Berg, D.J., W.R. Haag, D.W. Garton, and J.L. Farris. 1993. Responses of native unionids to encrustation by zebra mussels. (Abstract). Page 178 *in* K.S. Cummings, A.C. Buchanan, and L.M. Koch, eds. Conservation and management of freshwater mussels. Proceedings of a UMRCC symposium, 12-14 October 1992, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois.

Buchanan, A.C. 1989. Mussels (Naiades) of the Meramec River basin. Missouri Dept. of Conservation, Aquatic Series. No. 17. 68 pp.

Burr, B.M. and L.M. Page. 1986. Zoogeography of fishes of the Lower Ohio-Upper Mississippi Basin. *In* C.H. Hocutt and E.O. Wiley (ed.) Zoogeography of North American freshwater fishes. John Wiley & Sons, Inc., Hoboken, NJ.

Cavanaugh T.M. and W.J. Mitsch. 1989. Water quality trends of the Upper Ohio River from 1977 to 1987. Ohio Journal of Science 89:153-163.

Clark, A. 1995. Survey of the mussel beds in the lower Ohio River (ORM 438.1 – 981.)). Report to U.S. Army Corps of Engineers, Louisville, Kentucky.

Clarke, A.H. 1982. Survey of the freshwater mussels of the upper Kanawha River (RM 91-95), Fayette County, West Virginia, with special reference to Epioblasma torulosa (Rafinesque) and Lampsilis abrupta. USFWS, One Gateway Center, Room 618, Newton Corner, Mass. 02158. Order No. 50181-0546-2. 45 pp.

Dunn, H. 1995. Personal presentation at April 5 and 6, 1995 meeting in Columbus, Ohio to develop an action management plan for the Unionids in the Ohio River as a result of the zebra mussel (*Dreisenna polymorpha*) invasion.

Fenneman, N.M. 1917. Physiographic divisions of the United States: Annals of the Association of American Geographers, 6: 19-98. [2nd ed. 1921. 3rd ed. Revised and enlarged, 1928, 261-353 with map 17" x 28"]

Gloman, N.J. 1984. Barge facilities and mussel resources on the Ohio River. U.S. Fish and Wildlife Service, Bloomington, Indiana.

Hickman, M.E. 1937. A contribution to mollusca of east Tennessee. Unpublished masters thesis, Dept. of Zoology, University of Tennessee, Knoxville, 165 pp., 104 pl.

Johnson, J.E. 1987. Protected fishes of the United States and Canada. Amer. Fisheries Soc., Bethesda, MD. 42 pp.

Johnson, R.I. 1980. Zoogeography of North American Unionacea (Mollusca: Bivalvia) north of the maximum Pleistocene glaciation. Bull. Mus. Comp. Zool. 149(2): 189 pp.

Lambou, V.W. 1989. Management needs for fishes and fisheries dependent on overflow riverine wetlands *in* Proceedings of an International Symposium Wetlands and River Corridor Management, July 5-9, 1989 Charleston, South Carolina, USA. ED: Jon A. Kusler & Salley Daly, 520 pp.

Miller, A.C., B.S. Payne and F.W. Burns. 1997. Measures to minimize harm to *Lampsilis higginsi* caused by passage of commercial navigation vessels in the upper Mississippi River. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.

Ohio River Basin Commission. 1978. The Ohio Main Stem Water & Related Land Resources Study Report & Draft Environmental Impact Statement. Cincinnati, OH. 23 pp. plus appendices.

Ohio River Valley Water Sanitation Commission. 1998. 1994 – 1998 A Fifty-Year Pursuit for Clean Streams. Cincinnati, OH. 10pp.

Parmalee, P.W. and A.E. Bogan. 1998. The Freshwater Mussels of Tennessee. The University of Tennessee Press, Knoxville, TN. 328 pp.

Pearson, W.D. 1992. Historical changes in water quality and fishes of the Ohio River. Pages 209-231 *In* Water Quality in North American River Systems; C.D. Becker and D.A. Neitzel, ed. Batelle Press, Columbus, OH.

Pearson, W.D. and L.A. Krumholz. 1984. Distribution and status of Ohio River fishes. ORNL/SUB/79-7831/1. Oak Ridge National Laboratory, Oak Ridge, TN. 401 p..

Pearson, W.D. and B.J. Pearson. 1989. Fishes of the Ohio River. Ohio J. Sci. 89(5):181-187.

Preston, H.R. and White, G.E. 1978. Summary of Ohio River fishery surveys, 1968-76. Prepared for U.S. EPA, Region III, Philadelpia, PA. 10 p. + appendix.
Schloesser, D. 1995. Personal presentation at April 5 & 6, 1995 meeting in Columbus, Ohio, to develop an action management plan for the unionids in the Ohio River as a result of the zebra mussel (*Dreissena polymorpha*) invasion.

Steingraeber, M.T. 199(draft). Redistribution and Environmental Impacts of Nonindigenous Aquatic Species Associated with Operation and Maintenance of the Existing Upper Mississippi River System 9-Foot Navigation Channel. Report submitted to the U.S. Fish and Wildlife Service. 35 pp.

Thorp, J.H. 1992. Linkage between islands and benthos in the Ohio River, with implications for riverine management. Can. J. Fish. Aquat. Sci. 49: 1873-1882.

Tolin, William A. and Patricia A. Schettig. 1983. A physical and biological survey of the Ohio River islands (Huntington District). U.S. Fish and Wildlife Service. Elkins, WV. 102 pp.

Tuttle, M.D. 1979. Status, causes of decline, and management of endangered gray bats. J. Wild. Mgmt. 43:1-17.

Ulrich, R.G. Swenson and E. Nelson. 2002. Upper Mississippi and Illinois River Floodplain Forests – Desired Future and Recommended Actions. UMRCC Wildlife Technical Section.

U.S. Army Corps of Engineers. 2000. Ohio River Ecosystem Restoration Program – Integrated Decision Document and Environmental Assessment (Draft). U.S. Army Corps of Engineers, Louisville, Huntington, and Pittsburgh Districts. Louisville, KY. 68 pp. + Appendixes.

U.S. Fish and Wildlife Service. (undated, but most likely 1963). Fish and Wildlife Resources of the Ohio River Basin. U.S. Army Engineer Division, Ohio River-Cincinnati, OH. 74 pp.

U.S. Fish and Wildlife Service. 1980. Planning Aid Report, Gallipolis Locks and Dam Replacement Study. Elkins, WV. 120 pp. + Appendices.

U.S. Fish and Wildlife Service. 1982. Gray Bat Recovery Plan. Washington, DC, 26 pp. + Appendices.

U.S. Fish and Wildlife Service. 1985. Recovery plan for the pink mucket pearly mussel, Lampsilis orbiculata (Hildreth, 1828). Atlanta, GA. 47 pp.

U.S. Fish and Wildlife Service. 1985a. Final Fish and Wildlife Coordination Act Report, Lower Ohio River Navigation Study, Kentucky-Illinois. USFWS, Cookeville, Tennessee. 26pp.

U.S. Fish and Wildlife Service. 1986a. Fish and Wildlife Resources of the Upper Ohio River. State College, PA. 16 pp. + Appendix.

U.S. Fish and Wildlife Service. 1986b. North American Waterfowl Management Plan. U.S. Department of Interior, Washington, D.C., USA.

U.S. Fish and Wildlife Service. 1989. Final Environmental Assessment, Ohio River Islands National Wildlife Refuge Proposal.

U.S. Fish and Wildlife Service. 1991a. Reconnaissance Stage Planning Aid Report of the Uniontown Locks and Dam Study. Cookeville, TN. 4 pp.

U.S. Fish and Wildlife Service. 1991b. Fanshell (Cyprogenia stegaria (=C. irrorata)) Recovery Plan. Atlanta, GA. 37 pp.

U.S. Fish and Wildlife Service. 1993. Final Supplement Fish and Wildlife Coordination Act Report for the Lower Ohio River Navigation System Olmsted Locks and Dam. Cookeville, Tennessee. 5 pp.

U.S. Fish and Wildlife Service. 1994. Clubshell (Pleurobema clava) and Northern Riffleshell (Epioblasma torulosa rangiana) Recovery Plan. Hadley, MA. 68 pp.

U.S. Fish and Wildlife Service. 1999. Draft Fish and Wildlife Coordination Act Report for the J.T. Myers and Greenup Lock Improvement Projects. Cookeville, TN. 115 pp. + Appendices.

U.S. Fish and Wildlife Service. 2000. Draft Fish and Wildlife Coordination Act Report on the Ohio River Ecosystem Restoration Project Partnership Program. Cookeville, TN. 53 pp. + Appendices.

Van Hassel, J.H., R.J. Reash, H.W. Brown, J.L. Thomas, and R.C. Matthews, Jr. 1988. Distribution of upper and middle Ohio River fishes, 1973-85: I. Associations with water quality and ecological variables. J. Freshwater Ecol. 4 (4): 441- 458.

Williams, J.C. and G.A. Schuster. 1989. Freshwater Mussel Investigations of the Ohio River, Mile 317.0 to Mile 981.0. 1982. Eastern Kentucky University for the Kentucky Department of Fish and Wildlife Resources, Frankfort, KY 40601.

Yokley, P., Jr. 1972. Freshwater mussel ecology, Kentucky Lake, Tennessee. Tennessee Game and Fish Comm. Proj. 4-46R 133 pp.

Youger, J.D. and W.J. Micsch. 1989. Heavy metal concentrations in Ohio River sediments-longitudinal and temporal patterns. Ohio Journal of Science 89:172-175.

ATTACHMENT 2

DEPARTMENT OF THE ARMY
PITTSBURGH DISTRICT, CORPS OF ENGINEERS
WILLIAM S. MOORHEAD FEDERAL BUILDING
1000 LIBERTY AVENUE
PITTSBURGH, PA 15222-4186

REPLY TO
ATTENTION OF

SEPTEMBER 16 2008

Planning and Environmental Branch
Business Resource Division

Mr. Leroy Koch
US Fish and Wildlife Service
Kentucky ES Field Office
J C Watts Federal Building - Room 266
330 West Broadway
Frankfort, Kentucky 40601

Dear Mr. Koch:

We have reviewed your agency's Draft Fish and Wildlife Coordination Act Report (CAR), July 18, 2006, for the Ohio River Mainstem System Study's (ORMSS) System Investment Plan and Programmatic Environmental Impact Statement (SIP/PEIS). We thank you for a thorough and comprehensive discussion of resources on the Ohio River. We also want to express our appreciation for the Service's interest and active participation in the ORMSS throughout the course of the study. Your agency's input to the study process served to make the study report a high quality document.

We join with your agency in wanting to see the ecological resources of the river return to a fully sustainable level. In fact, since the initiation of the Mainstem System Study, the Corps has issued its Environmental Operating Principles along with ER 200-1-5, a policy for implementation. The Environmental Operating Principles direct the Corps to integrate environmental sustainability into all its activities. Throughout the study, the Corps has proactively sought the input of others. We convened the Interagency Working Group, prepared a report recommending an Ecosystem Restoration Program that was subsequently authorized, and completed a challenging assessment of cumulative effects on the river. We recognize the resources of the Ohio River have been affected by a number of actions including those of the Corps, and we accept responsibility and accountability for impacts of those actions under our jurisdiction.

The CAR provides a comprehensive list of recommendations to aid in achieving environmental sustainability. Those recommendations are grouped in several categories including riverine habitat and connectivity; stream habitat quality in the lower reaches of tributaries; mussels and snail fauna; fish fauna and fish passage; navigation impacts; island back channels, side channels and associated habitat conditions; flood plains; invasive species; and reduction of contaminants and excessive nutrients.

We would like to respond by first explaining our general capability for approaching ecosystem restoration and mitigation before we discuss the specific actions we intend to take pursuant to the SIP. Whereas most agencies with environmental missions were created through organic legislation that empowered them to use their discretion to fund authorized activities, the Corps of Engineers has no such programmatic authority. The Corps pursues missions such as navigation and ecosystem restoration as agreed upon between Congress and the President through project-specific legislation. Corps projects are authorized through Water Resources Development Acts and funded through annual appropriations bills. In reviewing the recommendations of your draft report, we note many recommendations that, although important and worthy of pursuit, are currently beyond the authority of the Corps acting alone. Implementation of the CAR recommendations would require a dedicated stream of funds and specific authorization to carry out. Since the SIP is a planning document and is not meant to go forward for Congressional authorization, it is unlikely we will obtain funding through this study.

The Corps of Engineers does have several continuing authorities at this time for addressing impacts attributed to ongoing actions, however, none of these can be implemented at full federal expense. For ecosystem restoration where a Corps project is causing or contributing to the degradation, Congress authorized Section 1135 of the Water Resources Development Act of 1986, as amended, for the Federal government to provide a greater share of project costs than under other ecosystem restoration authorities. Section 1135 is cost shared at 75% Federal and 25% non-Federal, whereas our other applicable ecosystem restoration authorities are cost shared at 65% Federal and 35% non-Federal. Section 1135 has a Federal funding limit of $5,000,000 per project. Therefore, it could not be used on a large scale. Section 216 of the River and Harbor and Flood Control Act of 1970 could, however, be used for large scale modification of projects but would be subject to the Act's 65/35% cost sharing requirement.

Accepting that the navigation system is causing or contributing to impacts to environmental resources of the Ohio River, the Corps understood its responsibility to implement ecosystem restoration. It was with this in mind that it recommended the Ohio River Ecosystem Restoration Program for authorization. As prescribed by legislative mandates and Corps policies, this program was created with a non-federal cost sharing requirement. This authority would provide up to $200 million in federal funds toward restoring the environment of the mainstem. Unfortunately, Congress has not chosen to provide any appropriations for this program to date. Since this program has not received funding, it is now a candidate for de-authorization. If appropriations are not provided, the program will be de-authorized on September 30, 2009.

That said, the Corps is committed to do all it can within legal and financial limits to mitigate for systemic environmental impacts. We recognize that our current actions on the Ohio River continue to have profound impacts on certain environmental resources associated with the river, most notably mussels and lithophilic fishes. These adverse effects are a result of maintaining navigation pools that reduce shallow water habitat and facilitate siltation of extensive reaches of formerly clean gravel or rubble substrate.

The Corps' recommended plan in the SIP is the first step toward mitigating (i.e., minimizing the effects of) traffic impacts. The areas of the river most subjected to navigation related impacts are the downstream approaches to the lock chambers where most of the remaining riverine habitat exists. By increasing reliability of the existing chambers (and constructing new chambers in the upper river), the time it takes to move traffic through this stretch of river will be reduced greatly. Transit days are the days it takes to move one tow from point of origin to its destination. By implementing reliability improvements, we estimate that transit days will be reduced by 1.5 million days over the 60-year study period. Since intra-pool transit rates will not change due to recommended improvements, the reductions will all be accounted for at the locks. Those days should be equally divided between up-bound and down-bound tows; therefore, there would be 750,000 fewer transit days, and concomitant impacts, in the lower approaches.

The Corps will consider incorporating sustainability-focused mitigation measures as identified in the SIP into its future actions. While potential measures identified in mitigation plans have typically focused on replacement-in-kind for anticipated adverse effects of planned projects, plans for future mitigation could, if agreed to by the resource agencies, include measures directed toward enhancing the environmental sustainability of affected resources and ecosystems. Such measures would be perceived as "sustainability-focused mitigation measures." Again, contingent on agency opinion, these measures could be implemented outside the geographic area of the site specific project if the benefits are great enough. We believe system-wide benefits would be cumulative over time as each site specific project is implemented.

To address more systemic issues related to the navigation system, the Corps will incorporate several environmental components into future site specific studies that this report recommends: evaluation of fish passage strategies at each lock and dam along the Mainstem during studies for lock modernization and major rehabilitation; continuance of the Interagency Working Group concept at the local level to participate in and to review and comment on studies as they progress; identification, description and quantification of riverine habitat within the individual project's area of influence; incorporation of sustainability planning within each individual project's area of influence; and, if a non-federal partner is identified, development of an Environmental Restoration Plan that will become part of the plan recommended for authorization of each site specific project. As required for navigation investments, however, all separable restoration costs will require a cost sharing partner.

At the invitation of the Fish and Wildlife Service, an annual meeting will be held between the Lakes and Rivers Division and District Commanders of the Corps and the Regional Directors of the USFWS Regional Offices with jurisdiction over the Ohio River to discuss where the agencies could become better stewards of the environment and participate, within our authorities, in making the river more sustainable.

Again, we thank you and all the Service participants for their valuable participation in the ORMSS. Your efforts have made the SIP/PEIS a better document.

Sincerely,

Michael P. Crall
Colonel, Corps of Engineers
District Engineer